PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

Volume XVI

PUBLISHED BY THE SOCIETY,
QUARTERLY
BALTIMORE, MD. WASHINGTON, D. C.
1914

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

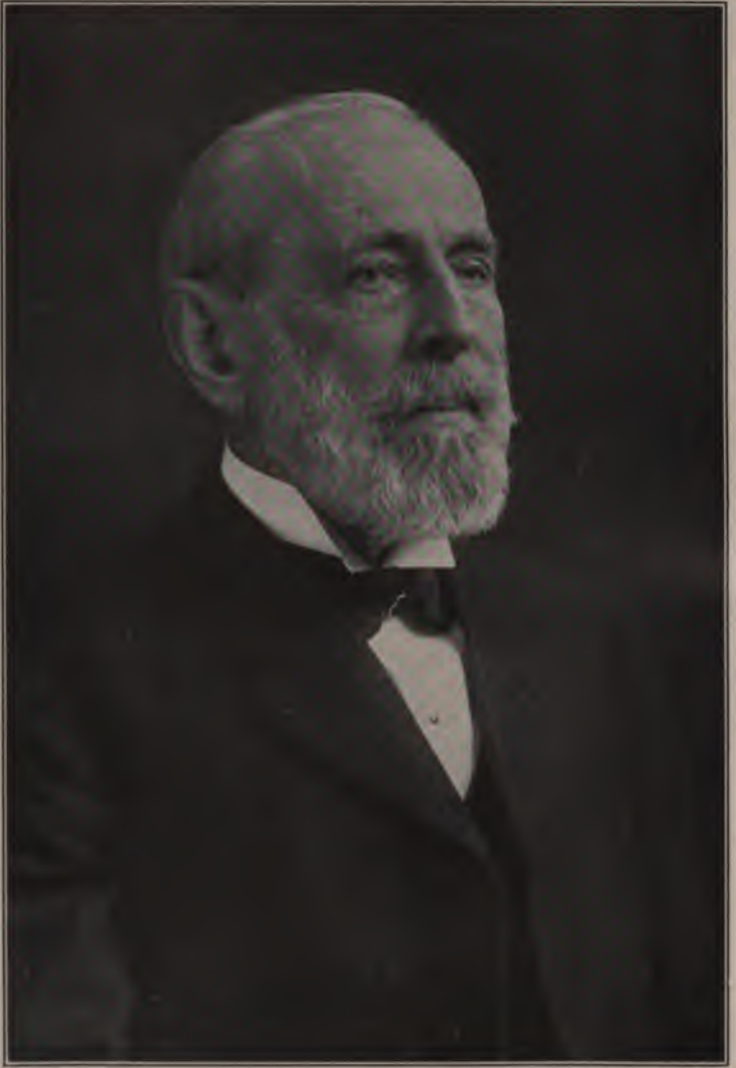
OF

WASHINGTON

Volume XVI

PUBLISHED BY THE SOCIETY,
QUARTERLY
BALTIMORE, MD. WASHINGTON, D. C.
1914

CONTENTS OF VOLUME XVI



PHILIP REESE UHLER

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVI | 1914 | No. 1

TWO HUNDRED AND SEVENTY-FIRST MEETING, NOVEMBER 6, 1913.

The following resolutions and biography were presented by a special committee consisting of E. A. Schwarz, Otto Heidemann and Nathan Banks and were accepted by the Society.

PHILIP REESE UHLER.

The Entomological Society of Washington learns with deep regret of the death, on October 21, of Dr. P. R. Uhler, of Baltimore, one of the founders of this society and one of its most distinguished members.

He was the first, and for many years, the only American authority on the order of Hemiptera, and though he published but little in recent years on account of his failing health, he will be remembered as one of the illustrious group, LeConte, Horn, Scudder, Osten Sacken, Edwards, and Cresson, who by their diligent and excellent work, brought American systematic entomology to that prominence which it has ever since maintained.

His genial nature, his kindness in helping younger students, and his charming hospitality will long be a cherished memory.

The Entomological Society of Washington desires to record its realization of the loss to the Society as well as to American Entomology, and to express to the family of Dr. Uhler its regard and sympathy.

LIFE AND WRITINGS OF PHILIP REESE UHLER.

Dr. P. R. Uhler was born in Baltimore on June 3, 1835, and died in that city on October 21, 1913. He was the eldest son of George Washington Uhler and Anna Maria Reese. His father was a prominent merchant of Baltimore, and the boy attended several

private schools and received a broad general education, including much training in Latin and German. When young Uhler was about ten years old his father bought a farm near Reisterstown, where the family often spent vacations. Here the boy began collecting insects, and was encouraged by the well-known Lepidopterist, the Rev. J. G. Morris and J. F. Wild, a German amateur Entomologist residing in Baltimore.

When of age his father placed him in his establishment, but the young man was so interested in collecting and studying geological, botanical, and zoological material that most of his time was spent in this way. He soon obtained a local reputation as an all around naturalist. Although in later life he specialized in Hemiptera, he never lost interest in the broader problems of natural history and science in general, and was always quick to perceive the application of these broader studies to his special work on Hemiptera.

In 1864 he was appointed by Prof. Louis Agassiz to take charge of the collection of insects in the Museum of Comparative Zoology. He also had charge of the library. Here he remained three years, during which time the Museum received large accessions of material. He made collecting trips for the Museum, to Maryland and to Haiti, West Indies. In 1867 he returned to Baltimore.

Before Dr. Uhler went to Cambridge he had been, for a short time, assistant librarian to the Rev. J. G. Morris, at the Peabody Institute. Upon his return he was again appointed, and in 1870 became librarian. Upon the death of the Provost of the Institute (Dr. N. H. Morrison) in 1880, he succeeded to that position, which he held until failing health compelled him to ask for retirement in 1911. He perfected the cataloguing system at the Institute.

His early work at the Peabody Institute allowed him sufficient leisure to study and publish on the Hemiptera. For many years he was practically the only authority on Hemiptera. The Hemiptera from the various government expeditions were sent him for study, and many private collectors gave him material. In 1875 he spent two weeks on the plains and mountains of eastern Colorado. Here he collected insects of all orders, and in addition to reporting on the Hemiptera, he made a report, with notes of habits and occurrence, on all other insects. About 1888, in company of his wife he visited Europe, purchasing books for the Peabody Institute and examining the Hemiptera in European collections. His entomological correspondence was very extensive, and in the course of years he had to determine many thousands of Hemiptera for his numerous friends and correspondents. But he attended to his arduous and often thankless work with the greatest patience and thoroughness.

With the increased duties at the Peabody Institute in 1890, and with the gradual failing of his eyesight he was forced to neglect systematic work and did little thereafter. The most important of his systematic papers are the revisions of the Cydnidæ and the Saldidæ. He had planned and partially completed a large work on the Capsidæ, but much of this was never published, and is now superseded by the papers of Reuter. Faunistic papers were especially favored by Dr. Uhler and some of them were published in the proceedings of our society. In each of these he presented some observations on the relationships of the Hemipterous fauna, or considerations on geographic distribution. In his systematic work he gave full, often elaborate descriptions, but rarely with figures or tables.

A few years before his death he donated his collection to the National Museum, but some of his types are in the Boston Society of Natural History and in Colorado, Kansas and California, while the West Indian types were returned to London. He described about six hundred species.

In his early life he published a few papers on economic entomology, Orthoptera, Coleoptera and Neuroptera, but his chief service in this order was the translation from the Latin of Dr. Hagen's Synopsis of North American Neuroptera. His types of Odonata and Orthoptera are in the Museum of Comparative Zoology. He also published several papers on archæology, and in later life on library methods. Some would say he was a naturalist of the old school; but no, he was a naturalist of Nature's school, a school to which all ages by patient work and untrammeled enthusiasm must ever pledge allegiance. As such the life of Uhler will be an inspiration to every young naturalist, who, amid the multiplicity of paths of modern investigation leading to some paltry rewards is tempted to forsake the love of Nature. Before his ill health Dr. Uhler often attended our meetings, frequently taking part in the discussion in an intelligent and animated way, and all who saw him will long remember how he and Henry Ulke would greet each other in the good old German fashion. The Washington entomologists will not forget the delightful meetings of our Society, held at Dr. Uhler's invitation at his hospitable home in Baltimore.

Dr. Uhler was connected with many scientific societies; besides being a charter member of ours. He was a fellow of the A. A. A. S., of the Entomological Society of America, of the American Entomological Society, and of the Philadelphia Academy of Natural Sciences, a founder, lecturer, and president of the Maryland Academy of Sciences, and an honorary member of the International Congress of Entomology. In 1900 New York University conferred on him the honorary degree of Doctor of Laws.

Personally Dr. Uhler was of medium height and build, and possessed a very congenial disposition that won for him a host of friends. He was a ready speaker and his lectures at the Maryland Academy were both interesting and instructive.

He was twice married, first in 1867 to Miss Sophia Werdebaugh of Baltimore, who died in 1883. A son of this union, Horace Scudder Uhler is now a professor in Yale. In 1886 Dr. Uhler married Miss Pearl B. Daniels, who had helped him prepare his List of Hemiptera. A daughter, Miriam D., and her mother remain to mourn their loss.

A list of Dr. Uhler's papers on Hemiptera, was published by Mr. Henshaw in Psyche in 1903, together with a useful index. His other papers have been fewer, and incorporated chronologically with his papers on Hemiptera in the following list.

THE WRITINGS OF PHILIP REESE UHLER.

1855 Descriptions of a few species of Coleoptera supposed to be new· Proc. Acad. Nat. Sci. Phil., 1855, pp. 415–18.

1857 Contributions to the Neuropterology of the United States. Proc. Acad. Nat. Sci. Phil., 1857, pp. 87–89.

1858 Descriptions of new species of Neuropterous insects collected by the North Pacific exploring expedition under Capt. John Rodgers. Proc. Acad. Nat. Sci. Phil., 1858, pp. 29–31.

Orthoptera, Hemiptera, and Neuroptera; in instructions for collecting insects. Ann. Rep. Smiths. Inst. f. 1858, pp. 164–67, 1859.

1859 Insects. Amer. Farmer, August, 1859, p. 39–40.

Insects, No. 2, Chinch-bug, lady-bird, Amer. Farmer, September, 1859, pp. 68–69.

1860 Hemiptera of the North Pacific exploring expedition under Com'rs. Rodgers and Ringgold. Proc. Acad. Nat. Sci. Phil., 1860, pp. 221–31.

1861 Insects injurious to vegetation. Rept. Comm. Patents, for 1860, Agriculture, 1861, pp. 312–322.

Homoptera of the North Pacific exploring expedition under Com'rs. Rodgers and Ringgold. Proc. Acad. Nat. Sci. Phil., 1861, pp. 282–284.

1861 Descriptions of four species of Hemiptera collected by the Northwestern boundary survey. Proc. Acad. Nat. Sci. Phil., 1861, pp. 284–86.

Rectification of the paper upon the Hemiptera of the North Pacific expedition. Proc. Acad. Nat. Sci. Phil., 1861. pp. 286–87.

Descriptions of a few new species of Hemiptera, and observations upon some already described. Proc. Ent. Soc. Phil., 1861, vol. I, pp. 21–24.

1863 Hemipterological contributions, No. I. Proc. Ent. Soc. Phil., 1863, vol. II, pp. 155–162.

1863 Hemipterological contributions. No. II, Proc. Ent. Soc. Phil., 1863, vol. II, pp. 361–366.

1864 Orthopterological contributions. Proc. Ent. Soc. Phil., 1864, vol. II, pp. 543–555,

1867 Some remarks on the Odonata of Haiti. Proc. Bost. Soc. Nat. His., vol. XI, pp. 295–298.

1869 Notices of the Hemiptera obtained by the expedition of Prof., James Orton in Ecuador and Brazil. Proc. Bost. Soc. Nat. Hist., 1869, vol. 12, pp. 321–327.

1870 (Podisus placidus) Amer. Ent. Bot. 1870, vol. II, p. 203.

1871 Notices of some Heteroptera in the collection of Dr. T. W. Harris. Proc. Bost. Soc. Nat. Hist. 1871, vol. 14, pp. 93–109.

1871 (Salt water Hemiptera). Amer. Jour. Science, 1871, ser. 3, vol. I, pp. 105–106.

A list of Hemiptera collected in eastern Colorado and northwestern New Mexico, by C. Thomas, during the expedition of 1869. Rept. U. S. Geol. Surv. Terr. Wyoming, 1871, pp. 471–472.

1872 Notices of the Hemiptera of the western territories of the United States, chiefly from the surveys of Dr. F. V. Hayden. Rept. U. S. Geol. Surv. Terr. Montana, 1872, pp. 392–423.

1875 List of the species of Hemiptera and Neuroptera obtained by Prof. James Orton, in northern Peru. Proc. Bost. Soc. Nat. Hist., 1875, vol. 17, pp. 282–286.

Report upon the collections of Hemiptera made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1873, and 1874. Rept. Geol. and Geog. Survey of Capt. G. Wheeler, 1875, vol. 5, pp. 829–842, pl. 42.

1876 List of the Hemiptera of the region west of the Mississippi River, including those collected during the Hayden explorations of 1873. Bull. U. S. Geol. and Geog. Surv. 1876, vol. I, pp. 269–361, pl. 19–21.

1877 Report upon the Hemiptera collected during the years 1874, 1875, by P. R. Uhler. Rept. Geol. Surv. of Capt. G. Wheeler. app. N. N. 1877.

Report upon the insects collected by P. R. Uhler, during the explorations of 1875, including monographs of the families Cydnidæ and Saldæ, and the Hemiptera collected by A. S. Packard, Jr., M.D. Bull. U. S. Geol. and Geog. Surv., 1877, vol. 3, pp. 355–475; 765–801, pls. 27–28.

1878 Notices of the Hemiptera Heteroptera in the collection of the late T. W. Harris, M.D. Proc. Bost. Soc. Nat. Hist., 1878, vol. 19, pp. 365–446.

On the Hemiptera collected by Dr. Elliott Coues, U. S. A., in Dakota and Montana, during 1873, 1874. Bull. U. S. Geol. and Geog. Surv., 1878, vol. 4, pp. 503–512.

1879 List of animals abserved at Fort Wool, Va. Studies biol. lab. Johns Hopkins Univ., 1879, vol. I, no. 3, pp. 17–34.

1880 Remarks on a new form of jassid. Amer. Entom., 1880, vol. 3, pp. 72–73.

1884 Order VI, Hemiptera. Standard Nat. Hist., 1884, vol. 2, pp. 204–296. Riverside Nat. Hist., 1888, vol. 2, pp. 204–296.

1886 Check list of the Hemiptera Heteroptera of North America. Brooklyn Ent. Soc., 1886, 30 pp.

A new noxious capsid. Can. Ent., 1886, vol. 18, pp. 208–209.

1887 (Lygus monachus.) U. S. Dept. Agric. Div. Ent. Bull., 13, 1887, pp. 63–64.

Observations on some North American Capsidæ. Ent. Amer., 1887, vol. 2, pp. 229–231.

Observations on some Capsidæ with descriptions of a few new species. (No. 2.) Ent. Amer. 1887, vol. 3, pp. 29–35.

Observations on North American Capsidæ with descriptions of new species. (No. 3.) Ent. Amer., 1887, vol. 3, pp. 67–72.

Observations on Capsidæ with descriptions of new species. (No. 4.) Amer. Ent. 1887, vol. 3, pp. 149–151.

1888 Preliminary survey of the Cicadidæ of the United States, Antilles and Mexico. Ent. Amer., 1888, vol. 4, pp. 21–23; 81–85.

1889 New Genera and species of the American Homoptera. Trans. Maryland Acad. Sci., 1888, vol. I, pp. 33–44.

1889 Observations upon the Heteroptera collected in southern Florida by Mr. E. A. Schwarz. Proc. Ent. Soc. Wash., 1889, vol. I, pp. 142–143.

Observations on the insects of the Bermudas. Heilprins' The Bermuda Islands. Phil., 1889, pp. 152–158.

1890 Observations on North American Capsidæ, with descriptions of new species. No. 5. Trans. Maryland Acad. Sci., 1890, vol. I, pp. 73–88.

1891 Observations on some remarkable forms of Capsidæ. Proc. Ent. Soc. Wash., 1891, vol. 2, pp. 119–123.

Remarkable new Homoptera. Trans. Maryland Acad. Sci., 1891, vol. I, pp. 143–147.

1892 Preliminary survey of the Cicadidæ of the United States, Antilles and Mexico. Trans. Maryland Acad. Sci., 1892, vol. I, pp. 147–175.

Additions to the family Cicadidæ. Trans. Maryland Acad. Sci., 1892, vol. I, pp. 175–179.

Observations on some remarkable Heteroptera of North America. Trans. Maryland Acad. Sci., 1892, vol. I, pp. 179–184.

1893 Summary of the collection of Hemiptera secured by Mr. E. A. Schwarz in Utah. Proc. Ent. Soc., Wash., 1893, vol. 2, pp. 366–385.

Hemiptera-Heteroptera of the Death Valley expedition. N. Amer. Fauna, 1893, no. 7, pp. 260-265.

A list of the Hemiptera-Heteroptera collected in the island of St. Vincent by Mr. Herbert H. Smith, with descriptions of new genera and species. Proc. Zool. Soc. London, 1893, pp. 705–719.

1894 A list of the Hemiptera-Heteroptera of the families Anthocoridæ and Ceratocombidæ collected by Mr. H. H. Smith in the island of St. Vincent; with descriptions of new genera and species. Proc. Zool. Soc. Lond., 1894, pp. 156–160.

On the Hemiptera-Heteroptera of the island of Grenada, West Indies Proc. Zool. Soc. London, 1894, pp. 167–224.

Observations upon the Heteropterous Hemiptera of Lower California, with descriptions of new species. Proc. Cal. Acad. Sci., 1894, ser. 2, vol. 4, pp. 223–295.

1895 An enumeration of the Hemiptera-Homoptera of the Island of St. Vincent, W. I. Proc. Zool. Soc. London, 1895, pp. 55–84.

A preliminary list of the Hemiptera of Colorado, with descriptions of new species by P. R. Uhler and J. H. Cowen, and the authors. Bull. 31 Colo. Agric. Exper. Station, 1895, pp. 1–137.

Summary of the Hemiptera of Japan, presented to the U. S. Nat. Museum by Prof. Mitukuri. Proc. U. S. Nat. Mus., 1896, vol. 19, pp. 255–297.

1897 Notes on predaceous Heteroptera with Prof. Uhler's descriptions of two species, by A. H. Kirkland. Can. Ent., vol. 29, 1897, pp. 115–18.

Contributions towards a knowledge of the Hemiptera-Heteroptera of North America. No. 1. Trans. Maryland Acad. Sci., 1897, vol. 1, pp. 383–394.

1897 New Hemiptera. Can. Ent., 1897, vol. 29, pp. 116–118.

1899 A new destructive capsid. Ent. News, 1899, vol. 10, p. 59.

1900 Aids to a recognition of some North American genera and species of the old family Fulgoridæ. Trans. Maryland Acad. Sci., 1900, vol. 1, pp. 401–408.

1901 Some new genera and species of North American Hemiptera. Proc. Ent. Soc. Wash., 1901, vol. 4, pp. 507–515.

1903 A new Cicada from Haiti. Trans. Maryland Acad. Sci., 1903, vol. II, p. 18.

Enumeration of the Cicadidæ of Brazil in the collection of Mr. Herbert H. Smith. Trans. Maryland Acad. Sci., vol. II, 1903, pp. 1–17.

1904 Recognition of two North American species of Cicada Latr. Ent. News, vol. 16, no. 3, pp. 74–77, 1904.

List of Hemiptera-Heteroptera of Las Vegas Hot Springs, New Mexico, collected by E. A. Schwarz, and H. S. Barber. Proc. U. S. Nat. Mus., vol. 27, pp. 349–361, 1904.

1905 Recognition of two North American species of Cicada Latr. Ent. News, 1905; pp. 74–77.

The Society also adopted the following resolutions presented by a special committee consisting of A. L. Quaintance, W. B. Wood and A. D. Hopkins.

A. G. HAMMAR.

The accidental death of Mr. Alfred G. Hammar, while hunting in the Capitan Mountains near Roswell, New Mexico, is learned with deep regret by the members of the Entomological Society of Washington. Mr. Hammar was a regular attendant of the meetings of the Society during his winter sojourns in Washington, and took a deep interest in its work, and by his contributions of papers and participations in discussions, added much of interest to its meetings.

Mr. Hammar accomplished much valuable work in the field of economic entomology, notably his thorough-going biologic studies of the codling moth in Pennsylvania, Michigan, and New Mexico, and of the grape root worm in Pennsylvania.

His genial nature and uniform courtesy to his associates have won him a place high in the esteem of all who had come to know him.

The Entomological Society of Washington wishes to here record its feeling of the loss to the Society, as well as to American Economic Entomology, and to express to his wife and brother its sincere sympathy.

The following papers were presented.

Coleoptera at the British Museum, Bloomsbury. T. D. A. Cockerell.
A new Tachinid Parasite of *Diabrotica vittata*. W. R. Walton.
Notes on the Entomology of the Arizona Wild Cotton. W. D. Pierce and A. W. Morrill.
Experiments with the Arizona Wild Cotton Weevil on Texas Cotton. B. R. Coad and W. D. Pierce.
Description of a New Blister Mite on Arizona Wild Cotton. Nathan Banks.
Two Microlepidoptera on *Thurberia*. August Busck.
The Chestnut Bast-miner. August Busck.[1]

COLEOPTERA AT THE BRITISH MUSEUM, BLOOMSBURY.

By T. D. A. Cockerell.

In the old days, which I am just old enough to remember, the natural history departments of the British Museum were in the original building in Bloomsbury, London. The entomologists had to work in underground rooms, which were so dark that critical work must often have been difficult, and we cannot wonder that some of the descriptions prepared there are hard to understand. Even at South Kensington, the light is not always as good

[1] Published in Ins. Ins. Mens., II, pp. 3–4, 1914.

as one could wish, but the conditions there are infinitely better than those in the old quarters. In spite of disadvantages, the entomologists of those earlier times were full of zeal, and gave a remarkable token of this in the collection they formed of beetles found on the Museum premises, either in the building or (principally) in the large, paved courtyard in front of it. This collection is still extant, and many years ago, when I was preparing a list of the insects of Middlesex, I was allowed to copy the data for use therein. Shortly after, I left England, and the list of Middlesex insects, which had appeared in part in the Entomologist, was discontinued, with only a very small part of the Coleoptera published. Looking over my old notes, I find I have still this British Museum list, and it occurs to me that some account of it may interest workers in the U. S. National Museum. The very large number of Coleoptera found at the British Museum may no doubt be attributed in part to the rather close proximity of Covent Garden Market. The market close to the National Museum at Washington may be expected similarly to be a source of insects wandering on to the Museum premises. Conditions at Bloomsbury are, however, much more thoroughly urban than those at Washington. Lists of this sort while not exhibiting the insects in their most natural surroundings, are of value and interest as showing how many species are spread by the agency of man, and may be found in the midst of cities and in other apparently unlikely places. When the facts are understood, we may marvel, not that so many insects are spread beyond their original habitat and establish themselves in new countries, but rather that more do not do so. Thus, it is really surprising that more European Coleoptera have not become established in America.

It is not worth while to give the whole list of British Museum beetles. I give instead the lists for several genera as a good sample of the whole. For each genus mentioned, I give all the species reported.

Cicindela campestris L.

Notiophilus aquaticus L., *palustris* Duft., *biguttatus* F.

Amara apricaria Payk., *familiaris* Duft., *acuminata* Payk., *trivialis* Gyll. *lunicollis* Schiodte, *similata* Gyll., *plebeia* Gyll.

Cercyon hæmorrhoidalis F., *flavipes* F., *unipunctatus* L., *quisquilius* L., *melanocephalus* L., *terminatus* Marsh., *nigriceps* Marsh.

Choleva fumata Spence.

Mycetoporus longulus Mann., *lepidus* Grav. *angularis* Rey, *clavicornis* Steph.

Philonthus splendens F., *laminatus* Creutz, *æneus* Rossi, *politus* F., *marginatus* F., *varius* Gyll., *sordidus* Grav., *cephalotes* Grav., *bipustulatus* Panz., *varians* Payk., *ventralis* Grav., *nigritulus* Grav.

Oxytelus rugosus F., *laqueatus* Marsh., *sculptus* Grav., *sculpturatus* Grav., *nitidulus* Grav., *complanatus* Er., *depressus* Grav.
Rhizophagus depressus F., *perforatus* Er., *parallelocollis* Gyll., *bipustulatus* F.,
Cryptophagus pilosus Gyll., *saginatus* Sturm, *scanicus* L., *badius* Sturm, *cellaris* Scop., *acutangulus* Gyll., *dentatus* Herbst., *distinguendus* Sturm, *bicolor* Sturm, *vini* Panz.
Phyllotreta vittula Redt., *undulata* Kuts., *nemorum* L.
Alphitobius diaperinus Panz., *piceus* Ol.
Otiorhynchus scabrosus Marsh., *sulcatus* F.,
Hypera punctata F., *polygoni* L., *nigrirostris* F.,
Hylesinus crenatus F., *fraxini* F.,
Tomicus typographus L., *chalcographus* L.

In the list as it stands, I find in *Tenebrio* only *molitor* L. (no *obscurus*); in *Bruchus* only *flavimanus* Boh. Possibly some of the very common species were not preserved. In *Cerambycidæ* I find only five species: *Callidium alni* L., *C. variabile* L., *Gracilia pygmæa* F., *Molorchus minor* L., *Acanthocinus ædilis* L., *Chrysomela* is represented only by *polita* L., a species common around London (Isleworth, Bedford Park, Hendon). There are only four *Histeridæ*: *Hister cadaverinus* Hoff., *H. purpurascens* Herbst., *Saprinus æneus* F., *Dendrophilus punctatus* Herbst. The only *Dytiscidæ* are *Hydroporus pubescens* Gyll., H. *palustris* L., *Agabus bipustulatus* L. and *Acilius sulcatus* L.

——Mr. Schwarz said that he believed there is a list of the insects of Paris. He also remembered that many years ago the Entomological Society of Berlin brought together a list of the insects found in the city of Berlin. The number of insects found in the city of Washington, D. C., is immensely greater than that found in most other cities, a fact which is easily explained by the large number of squares and parks. There should be an unpublished list of the insects found on the Smithsonian grounds present in the old files of the Division of Entomology. In this connection he mentioned a curious fact namely, that there is at the corner of 12th and D Streets an ash tree which thirty-five years ago was badly infested with a Lepidopterous borer, *Agalia polistiformis*, and on which two predaceous Elaterid beetles, *Chalcolepidius viridipilis* and *Hemirhipus fascicularis* were always to be found. Today the same tree is still living and harbors the same insects.

——Dr. Hopkins mentioned the large number of species of forest insects, injurious, beneficial, and neutral, which were attracted by

the odor of pine lumber in the extensive lumber yards of B Street N. W. As a consequence a large number of old Norway spruce trees on the Agricultural Grounds have died during the past three years, having been killed by three species of Scolytids—*Ips calligraphus*, *Ips grandicollis*, and *Ips avulsus*, the first attacking the lower trunk, the second the upper portion, and the third the tops and branches. Each species has its usual set of parasitic and predatory enemies, associates, and scavengers, making in all quite an extensive fauna.

A NEW TACHINID PARASITE OF DIABROTICA VITTATA.

By W. R. Walton, *Bureau of Entomology.*

One Tachinid parasite of *Diabrotica* has been known to science since 1871, in which year *Celatoria* (*Melanosphora*) *diabroticæ* was described by Dr. Henry Shimer.[1] Subsequently the late D. W. Coquillett redescribed this species under other generic and specific names.[2]

Shimer's brief and characterless description of *diabroticæ* together with his placing of the species in the genus *Melanosphora* of the Dexiidæ offer an excellent excuse for this redescription and synonymous specific name. Shimer's figure, depicting the wing venation fairly well, affords the one clue which preserves his diagnosis from oblivion.

In his redescription of *C. diabroticæ* Mr. Coquillett unfortunately confuses the sexes as he says: "Venter in female normal: in the male, furnished with a large, longitudinally compressed process." As a matter of fact the female is the possessor of this process which is excellently shown in Dr. Marx's drawing accompanying his article. Mr. C. H. T. Townsend has previously commented upon this misinterpretation.[3] Mr. Coquillett also describes here for the first time the peculiar spiny puparium which is quite distinctive of this group, for which Mr. Townsend proposes the name *Celatoriinæ*.

During the early part of June of the present year a wild cucumber vine on the premises occupied by the author at Hyattsville, Maryland, became heavily infested with the beetle, *Diabrotica vittata* Fabr. While observing the movements of the beetles on June 4, several minute tachinid flies were seen sitting upon the upper sur-

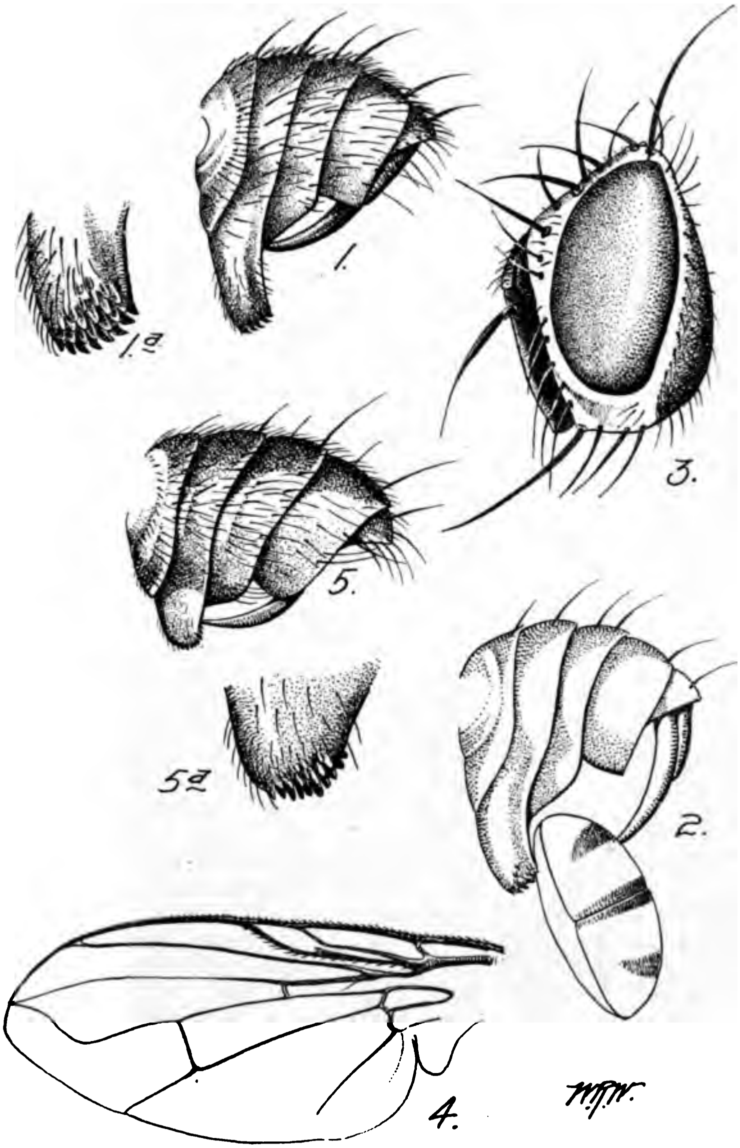
[1] American Naturalist, vol. v, p. 219, 1871.
[2] *Celatoria crawii*, Insect Life, vol. II, p. 235, 1890.
[3] Annals Ent. Soc. of Am., vol. IV, p. 140, June, 1911.

faces of the leaves. Suddenly one of these individuals dashed at a beetle, they grappled, the beetle rolled over upon its back. Then, almost instantly, the fly disengaged herself, resuming the pose upon the leaf, preening her body with the hind legs. The beetle rolled off to the ground and presently flew away. This was observed several times and finally a fly and the beetle attacked were captured for examination. The beetle was found to have a clean hole punched through the center of one elytron. An examination of the abdominal appendages of the fly (plate I, fig. 1) left little doubt as to the origin of this puncture. By referring to the figure it will be seen that the second abdominal segment is immensely prolonged downward into a laterally compressed tubercle, the apex of which is armed with short, flattened, somewhat pointed, spine-like, processes, directed slightly caudad. Opposed to this, with its base attached to apex of the abdomen, is a long curved, strongly chitinized piercer. This is normally held with its tip ensheathed in the posterior edge of the abdominal process described above. In life it is easily visible with the aid of a hand lens. Figure 2 of plate I shows the author's interpretation of the function of these two appendages.

The contact of the fly with the beetle is much too brief and the conflict too strenuous for the eye to observe what actually takes place. But taking into consideration the position of the punctures on the elytra of the beetle and the conformation of the puncturing apparatus, together with the fact that the beetle is turned upon its back during the conflict, this hypothetical figure seems quite plausible.

Several punctured beetles were collected and placed in a breeding jar and on July 10 one fly puparium was found therein. This resembles the puparium of *Celatoria* quite closely in that it is covered with short, spine-like processes. Owing to the writer's prolonged absence from the city, further results of this rearing were lost. But the facts outlined above indicate conclusively the parasitism of this fly on *Diabrotica*.

When first observed it was naturally supposed to be *Celatoria diabroticæ* Shimer. In size and general appearance it closely resembles that species but a careful examination revealed important structural differences which make it necessary to propose not only a new species but also to erect a new genus for its reception. This latter action becomes necessary because the first vein is spiny for almost its entire length. It seems quite apparent that this character is wholly artificial, but as it has been utilized extensively as a primary generic and even group character, and is of undoubted convenience in spite of its apparent artificiality, the name *Neocelatoria ferox* n. gen. n. sp. is herewith proposed for this curious fly.



Neocelatoria ferox Walton; *1*, Abdomen of female; *1a*, Enlarged view of abdominal tubercle; *2*, Hypothetical drawing showing probable functioning of appendages; *3*, Head of female; *4*, Wing.

Celatoria diabroticæ Shimer; *5*, Abdomen of female; *5a*, Abdominal tubercle enlarged.

Neocelatoria n. genus.

First vein bristly on its apical two-thirds; face on lower half of sides bare; proboscis scarcely longer than height of head; apical cell ending at wing tip barely open or slightly closed; eyes bare; frontal vitta opaque; palpi subcylindrical; penultimate joint of arista slightly longer than broad; sides of face at narrowest point not nearly one-third as wide as median depression; head at vibrissæ shorter than at root of antennæ; horizontal diameter of occiput above neck less than one-half length of eye. With one or more frontal bristles below base of antennæ. Female with one or two pairs of orbitals. Female with second segment of the abdomen prolonged ventrally into a long setigerous tubercle, quite twice as deep as the fourth abdominal segment.

Neocelatoria ferox n. sp.

Minute, blackish, wings broad, hyaline, Eyes large, occupying nearly two-thirds of the head, each fully as wide as front. Front cinereous, sides nearly parallel. Vertex slightly black. Frontal vitta dark brown, nearly black, occupying about one-third of the front immediately over root of antennæ, gradually widening towards vertex where it occupies fully one-half of the width of front. Entire face including depression cinereous; sides at narrowest part not more than one-tenth as wide as depression; antennæ black, slightly cinereous, almost or quite as long as face. Third joint at least five times as long as second; artista thickened to the middle; second joint slightly longer than broad; post vertical and ocellar bristles strong. Usually two pairs of orbital bristles (in female), frontal bristles descending nearly to tip of second joint; proboscis short, fleshy, black; palpi yellow. Beard and hairs of lower occiput white; vibrissæ on oral margin; oral cavity large, occupying the entire width of face. Facial ridges bristly on more than lower half; thorax black, humeri and median vitta thinly gray pollinose to the transverse suture; posterior to this nearly bare. Abdomen black, shining, somewhat laterally compressed; bases of second, third and fourth segments thinly gray pollinose. First segment without marginals; second segment bearing marginals only; third segment bearing a pair of small discals and marginals; fourth with a marginal row only. Post sutural bristles three; sternopleurals three with some coarse hairs. Scutellum black, bearing three pairs of long marginals, the apical pair the smallest. Abdomen viewed from the side showing a deep, compressed, setigerous prolongation of the second segment, the lower end of which projects considerably below the level of the bottom of hind coxæ. Ovipositor and piercer black, strongly chitinized, slightly compressed laterally, curved forward with its tip ensheathed in the prolongation of the second segment. Legs rather stout, black; middle tibiæ with a single strong bristle on the front side near middle; hind tibiæ not ciliate; wings clear hyaline; hind cross vein nearly rectangular, straight; veins brown; halteres yellow; calypters whitish; length three to four mm.

Described from two females collected at Hyattsville, Maryland, June 4, 1913. Type a female deposited in U. S. National Museum, Washington, D. C. A figure of the abdomen of *Celatoria diabroticæ* has been provided for the purpose of comparison (plate I, fig. 3).

NOTES ON THE ENTOMOLOGY OF THE ARIZONA WILD COTTON.

By W. D. Pierce and A. W. Morrill.

Arizona wild cotton, *Thurberia thespesioides*, has been under observation for several years, by Prof. J. J. Thornber, of the University of Arizona, who has acquired specimens from many different localities in southern Arizona and has in fact recommended it as a flowering shrub. Possibly it first received attention from an entomological standpoint from one of us (Morrill), when, in August, 1912, in company with Prof. R. H. Forbes, director of the Arizona Experiment Station, several plants were found and examined near Fish Creek on the Roosevelt Road, where the plant had not previously been known to exist. A considerable number of bolls were examined, but no insect injury of any kind was noted. Believing that the cotton boll weevil would attack this as a food plant, a number of the bolls and squares were mailed to the laboratory of the Bureau of Entomology at Dallas, Texas, for testing with live weevils. This material was not received in good condition, however, so the testing of the attraction of the Arizona wild cotton for the typical *Anthonomus grandis* was deferred until the past summer.

The plant assumed economic importance when Mr. O. F. Cook made an announcement in February, 1913, of the finding of the Mexican cotton boll weevil in the bolls in Sabino Canyon, Santa Catalina mountains. This announcement was followed very shortly by the receipt at Washington of a sack of infested bolls from Stone Cabin Canyon, Santa Rita Mountains. Out of a total of 743 bolls, 220 weevil stages were obtained. Of these, 171 were dead but 18 live adults were found in their cells. In the bolls the mortality was provisionally classified as follows:

	per cent
Due to climatic causes	65.00
Due to predators	2.27
Due to parasites	1.82
Due to fungus	8.63
Total for all classes	77.72

[redacted]

Among the parasites were found the traces of two specimens of a *Cerambycobius*. The remaining parasites were Braconids. The material also contained thirteen stages of a Lepidopterous boll feeder, of which one larva was found alive. A predaceous Coleopterous larva was also found.

During the last two weeks in August the authors made a thorough examination of the insects associated with this plant in several localities in Arizona.. The lowest altitude at which the plant was found growing was about 2500 feet in Fish Creek Canyon, sixteen miles west of Roosevelt. In this section the plant is quite common not only on the side of the canyon a short distance above the bed but even on the top of the high plateau nearby at an elevation of approximately 3300 feet. Many squares, a few blooms and a few bolls were found on the plants in this section on August 19. No weevil indications could be found here.

On the following day a search was made for the wild cotton plant in one of the canyons near Roosevelt and in a side canyon which opens into Fish Creek Canyon, but no wild cotton plants were found. Judging from observations afterward made in the Santa Catalina and Santa Rita Mountains the authors would consider both of these canyons as likely places for the plant to occur.

Owing to the extensive cultivation of cotton in the Salt River Valley below this point a search has been made for the plant in Hieroglyphic Canyon and also in another canyon of the Salt River Mountains south of Phœnix, by Mr. E. E. Russell under direction of the Arizona State Entomologist's office. No trace of the plant was found. It is quite probable that the wild cotton exists somewhere nearer the Salt River Valley cotton plantations than Fish Creek but no search other than mentioned has yet been made.

From Phœnix we proceeded to Tucson which is on the mesa surrounded by mountain ranges. The presence of cotton at Tucson lent considerable importance to the conditions here. Within a few years cotton will be grown for twenty or thirty miles in the Santa Cruz Valley if conditions permit. North of Tucson and coming within a very few miles of the cotton fields already planted are the Santa Catalina Mountains. The plant occurs according to our observations and those of Professor Thornber in Pima, Ventana, Sabino, Bear and Soldiers Canyons in this range. We found the weevil in the second and Mr. Cook found it in the third. It no doubt will be found in the others. Joining these mountains on the east are the Tanque Verde and Rincon Mountains in both of which ranges the plant occurs. South of Tucson about thirty miles are the Santa Rita Mountains in which the wild cotton is common. We found it in Sawmill and Stone Cabin Canyons, with the weevil abundant. West of Tucson is a very dry unpromising range of mountains, the Tucson Mountains, in which we found

absolutely no signs of the plant. Outside of our records *Thurberia* is known also to occur in the Mule Pass, Chiricahua, and Huachuca Mountains, at Ft. Bowie, Davidson Springs and near Dragoon, Arizona, and in southwestern Chihuahua and Guadalajara, Mexico.

In altitude the plant occurs from 2300 (Fish Creek Canyon, Arizona) to 5000 feet. (Sawmill Canyon, Santa Rita Mountains, Arizona.) According to Mr. F. L. Lewton it occurs as high as 7000 feet altitude in Mexico. It is perennial, resembling the cotton plant so closely that it is locally known as wild cotton.

Entomologically *Thurberia* is a very interesting plant. The large nectary of the midrib on the underside of the leaves, the three nectaries at the base of the involucral bracts, and the nectar of the flowers prove powerful attractions to insects. The tender foliage and the succulent buds and bolls furnish excellent insect food.

BOLL WEEVIL.

By far the most important species attacking the wild cotton is the boll weevil, *Anthonomus grandis*, var. *thurberiæ* Pierce which is known to breed in the squares and bolls in Ventana and Sabino Canyons of the Santa Catalina Mountains, and Sawmill and Stone Cabin Canyons of the Santa Rita Mountains. It passes the winter spring and summer in cells in the bolls, emerging in August or as late as September 1 to begin attack on the new crop of squares and bolls. It hardly seems possible that the weevil can have more than two generations a year on this plant. The eggs are laid at the base of squares, and are covered by a transparent gelatinous scale upon which is usually a little clot of excrement. The eggs are elongate, often twice as long as wide. On August 25 in Stone Cabin Canyon no larvæ were found over one-fifth grown, although it is quite possible the weevil may develop earlier in the lower canyons. The first adults were bred from Stone Cabin Canyon bolls about November 10.

The adult weevils are robust and generally larger than the Mexican cotton boll weevil and one receives a very strong impression that he is dealing with a distinct species. The records made by Mr. Coad at Victoria, Tex., however, have proven the Arizona form to be conspecific with the cotton boll weevil. The typical *grandis* occurs at altitudes under 2000 feet, while *thurberiæ* is found only at altitudes of over 4000 feet. The food plants are considered generically different by botanists. Geographically the two varieties are separated by hundreds of miles. The cotton weevil occurs in Cuba, Costa Rica, Mexico and the southern United States while *thurberiæ* occurs in southern Arizona and also probably in the mountains of Mexico.

LEAF WORM.

Next in interest is *Alabama argillacea*, one full grown larva of which was found on *Thurberia* in Stone Cabin Canyon, while the species was also found on the extremely isolated patch of cotton at Tucson thirty miles distant to the north, and also in the cotton fields at Phœnix. This species is known to display a tremendous power of flight in its annual northward dispersion. The question of greatest interest is whether the mild winters of Phœnix and Tucson will enable it to hibernate in Arizona and be present for the next cotton crop. At Victoria, Texas, Mr. Coad experimentally fed *Alabama* larvæ on his Thurberia plants and in some experiments gave them a choice between cotton and Thurberia leaves but found that they fed on both and that they matured normally when fed on the *Thurberia*. On the other hand they did not seek the *Thurberia* naturally.

This insect occurs on cotton in South and Central America and the West Indies, and only comes into the United States in warm seasons. It has never previously been taken on any other food plant than cotton.

The absence of the cotton worm with the single exception noted, in the sections where the Arizona wild cotton was examined, indicates the improbability of the insect being indigenous to Arizona. The discovery of the insect upon cultivated cotton near Tucson the first season of its growth in that locality is almost positive evidence that the moths of this insect had reached Arizona by flight from points hundreds of miles to the south.

THE THURBERIA BOLL WORM.

The Thurberia boll worm is considered the most destructive of all the insects found attacking Arizona wild cotton. During the latter part of August the eggs of this Noctuid were very abundant in Stone Cabin Canyon in the Santa Rita Range and were also found in Sawmill Canyon a few miles distant, but in this latter locality they were noticeably scarce. In Ventana Canyon in the Santa Catalina Mountains one of the authors (Morrill) in company with Prof. G. F. Freeman on July 1, 1913, estimated that about a fourth of the old bolls attached to the plants had been eaten out by worms, undiscovered at that time. A single old boll similarly destroyed was found at Fish Creek Canyon in August. Further evidence of the wide distribution of the insect in Arizona exists in the eggs found upon the herbarium specimens of the National Museum from near Bisbee (probably in Mule Mountains) and from the Rincon Mountains. It is of interest to note that the first of these records is dated September 14, 1892.

The egg is pure white in color, truncate-conical in form, with crater like apical depression. Greatest diameter 0.79 to 0.83 mm. height, 0.79 to 0.8 mm.; diameter of entrance to apical cavity, 0.13 mm.; edges ragged. Surface of eggs marked with slightly depressed reticulations forming polygonal cells, small at base of the eggs and gradually increasing in size as the diameter of the egg decreases. About 52 cells occur around largest circumference and about 21 cells around smallest circumference. As the embryo develops the egg gradually becomes distinctly pinkish.

The pupa is robust measuring about 10 mm. in length, and 5 mm. in width. Its color is light brown with dark brown spiracles.

The full grown larva is about 25 mm. in length, 5 mm. in diameter and cylindrical in general form. The head and cervical shield are yellowish brown in color as is also the anal shield. The spiracles are jet black. Integument marked with a rather broad stripe of deep pink extending along each side of the body interrupted at the joints. This stripe shades to paler pink above. Dorsal organ greenish and conspicuous. Where integumental color is absent or pale the body fluid and internal organs give greenish tone. In the younger stages the larvæ are more distinctly pinkish in color and lack the green tinge.

The eggs are deposited exclusively, as far as observed, on the tips of the involucral bracts and of the leaf lobes. Of 40 specimens of eggs 35 were found to occur singly. The exceptions consisted of one group of three and one group of two eggs.

The larva does not eat the egg shell after emergence nor has it been found feeding except upon the squares and bolls. Into these parts it eats its way exhibiting feeding habits quite similar to those of the cotton boll worm (*Heliothis obsoleta*). The young larva eats into several of the squares and finally attacks a boll and finishes growth inside of one. No observations have been made showing the number of bolls a single larva may destroy. The stems which bear the damaged boll are fastened to the plant by a band of silk apparently spun by the larva as it approaches the boll. This is strong enough to hold the boll if the stem should become detached as it sometimes does, but it seems probable that there is some other purpose in this action. The entrance to the cotton boll is made almost invariably near the base between the bracts. It is 2.25 and 3 mm. in diameter in the specimens observed.

When placed together the worms do not show cannibalistic tendencies. Sixteen out of nineteen worms under observation removed from the bolls which they had completely eaten out, burrowed into the ground without hesitation. Pupal cells thinly lined with silk were constructed at depths of from one to three inches below the surface. The Thurberia boll worms appear to

feed upon Egyptian cotton as readily as upon the wild cotton. One worm about one-half grown on October 2 was placed in a hole cut through the carpel of an Egyptian cotton boll and four days later it was noted that it had consumed two cotton seeds and having plugged up the artificial entrance hole with excrement it had made a new hole as an exit. In two instances larvæ about three-fourths grown were placed inside bracts of Egyptian cotton squares and ate out the interior of the flower bud in each case.

A few observations indicate the general similarity of the seasonal history of the Thurberia boll worm with that of the Thurberia boll weevil. No eggs or larvæ of the boll worm were found on July 2 in Ventana Canyon although the insects were abundant there as indicated by the large percentage of old injured bolls as noted above. The plants at that time were far advanced in their development as compared with other localities; squares and blooms were abundant and a few half grown bolls were seen. On August 25 in Stone Cabin Canyon it was estimated that 50 per cent of the eggs of the Thurberia boll worm had already hatched. Pink lepidopterous larvæ associated with these eggs, and now known to be the young boll worms, were found boring into the squares of the wild cotton plant. The worms found were in no case of greater length than 10 mm. and were therefore less than one-half grown. On September 1 worms of full size were found in the Ventana Canyon by Messrs. Pierce and Thornber and on October 1, Dr. O. C. Bartlett collected in the same canyon 24 boll worms of which 18 were full grown, four about three-fourths full grown, one about one-half grown and one about one-third grown.

After reaching full size the worms apparently remain for a considerable period inside the empty boll, but as far as observed they do not pupate there. Specimens which went into the ground and pupated during the first ten days of October have not yet (November 15) emerged.

Dr. Dyar, who has examined the larvæ finds that they resemble those of *Sacadodes pyralis* Dyar, the pink boll worm of cotton in Trinidad.

BLISTER MITES.

In the Santa Rita and also the Santa Catalina Mountains we found quite commonly a blister mite of the genus *Eriophyes*, to be described as new by Mr. Banks. The tiny eggs of this species are found in clusters like raspberries on the foliage in August. The mites are so numerous that their feeding causes the surface of the leaf to take on a fuzzy brown appearance. In Ventana Canyon many plants were found killed or almost so by this species which was abundant on both sides of every leaf and on the stems and

squares. It is of interest to note that a mite of this genus (*Eriophyes gossypii*) attacks cotton in Montserrat, St. Vincent, and St. Lucia of the West Indies.

LEAF GALL.

A species of Itonididæ (Cecidomyiidæ) is very common upon the plants in Stone Cabin Canyon. This insect oviposits in the midribs of the tiny leaves causing the leaves to form a sort of pocket-gall, but not preventing the leaf from completing its growth somewhat deformed. Within the walls of this gall the larva feeds. We have no Itonidid enemies of cotton in the United States but in the West Indies, *Contarinia gossypii* does considerable damage.

MEALY BUG.

A species of mealy bug (*Pseudococcus sp.*) was found on Thurberia near McCleary's Ranch in Stone Cabin Canyon on August 25. Between 20 and 25 specimens in all were collected and observed including two specimens of adult females. These insects were in most instances found inside rolls of the leaves evidently produced by the Itonidid maggots which are mentioned above. One of the full grown female specimens confined in a box without food gave birth to between fifteen and twenty larvæ within twelve hours. The two adults and several specimens one-half to three-fourths grown were kept in vials and fed upon Thurberia squares hoping to breed a sufficient supply for study. Later (after September 3) the insects were fed on Egyptian cotton squares at Phœnix. In all about fifty specimens were cared for but notwithstanding daily attention no more adults were bred and the mature females soon died.

It is suspected that the wild cotton mealy bug is the same as that found on *Gærtneria xanthocarpa* in Pima Canyon on August 23 and that the same species was found on *Thurberia* in Ventana Canyon on August 31. On October 1, Mr. O. C. Bartlett was unable to find any additional specimens on wild cotton in Ventana Canyon.

The following notes were made concerning the adult specimens: Length 5.5 mm., width 3 mm., color shining dark gray. Short marginal ribbons of wax increasing slightly in length, posteriorly. No conspicuous marginal spines. Newly born larvæ quiescent with wax filaments from the body of the adult among them making a loose cottony mass.

In one vial containing an adult female and larva mass a dipterous pupa appeared. This was bred out and proved to be a species of *Leucopis*.

Mr. Coad was able to carry this mealy bug on cotton leaves at Victoria for a month.

MISCELLANEOUS INSECTS BREEDING ON THURBERIA.

A very tiny leaf miner was found quite abundantly in all of the places where we found the plant. This species has not yet been bred, but is quite different from the ordinary cotton leaf miner.

A new species of *Bucculatrix* was found feeding on the leaves of Thurberia in all the places investigated, and at McCleary's Ranch in Stone Cabin Canyon, this species had found the three or four plants which had been grown there at an altitude of about 4000 feet. The tiny larva of this species spins an elongate white corrugated cocoon less than ¼ inch long. The species will be described by Mr. Busck. Specimens of this genus have been found on cotton in Mexico.

Another Lepidopterous larva, determined by Mr. Busck as *Dichomeris deflecta* Busck, makes a fold in the leaf by means of two or three silken threads, and feeds within this fold. It is very active and when its hiding place is disturbed quickly slips out. It pupates in its fold. It fed on cotton at Victoria, but Mr. Coad could not carry it through to maturity. It is parasitized by a species of Braconidæ.

A species of Geometridæ was very commonly found feeding on the foliage of Thurberia in Stone Cabin Canyon. Geometridæ are commonly found on cotton.

One beautiful yellow and brownish Bombycine larva was found feeding on a Thurberia plant in Stone Cabin Canyon. This was successfully bred by Mr. Coad and determined by Dr. Dyar as *Lirimiris truncata* H. S., a species new to the United States.

A species of *Ephestia* breeds in the bolls quite commonly. Only one specimen has so far been carried to maturity. This was determined by Dr. Dyar.

A very pretty yellow *Spilochalcis* was bred in May from bolls infested by the *Ephestia*, and is very probably a parasite of it.

Two species of Thysanoptera were found in Thurberia flowers. Several specimens of *Frankliniella insularis* Franklin, (*Euthrips*) determined by A. C. Morgan, were found in a flower in Stone Cabin Canyon. This species occurs in Mexico, at Brownsville, Texas, and in Barbados.

A Ptinid, *Prostephanus truncatus* Horn breeds abundantly in the dead stalks. One Cerambycid stalk-boring larva was also found in Stone Cabin Canyon.

A Scutellarid, *Aulacostethus marmoratus* Say was found commonly feeding and breeding on dead bolls of Thurberia.

Twice in Stone Cabin Canyon a species of Eucharidæ was observed ovipositing in apparently healthy squares. In one instance the sprig was gently plucked and transferred to a vial without disturbing the tiny insect and both of us observed its ovipositor in-

serted in the square. This specimen is described as a new species of *Chalcura* by Mr. Crawford.

At Victoria, Texas, Mr. Coad's Thurberia plants became heavly infested by *Aphis gossypii*,

MISCELLANEOUS VISITORS.

The majority of the miscellaneous insects visiting this plant were present for its nectar although some were predatory.

The Hemiptera should probably be included among the injurious insects, but no definite records of feeding were obtained against those not already mentioned. An *Aleyrodes* in the winged form was occasionally seen. Mr. Heidemann has determined the following species taken in Stone Cabin Canyon: *Lygæus bicolor* H. S., *L. lateralis* Dall, *Dendrocoris arizonensis* Barber, *Corizus punctatus* Signoret, *Notocyrtus* sp. and *Creontiades rubrinervis* Stal. From Thurberia in Pima Canyon we obtained *Lopidea confluens* Say and an *Empoasca*. A *Zelus renardii* Stal was collected in Ventana Canyon.

One small brown female Mantis, *Litaneutria obscura* Scudder, and two species of grasshoppers, *Barytettix neomexicana* Scudder, and a *Schistocerca* found only in nymphal stages, were taken in Stone Cabin Canyon, and the Barytettix was also on the plant in the Santa Catalina Mountains. These insects were determined by Mr. Caudell.

The following beetles determined by Mr. Schwarz were collected on *Thurberia* at Fish Creek, *Scymnus ardelio* Horn, two species of *Attalus*, one of them new, *Petalium bistriatum* Say and *Lema balteata* Le Conte. In Stone Cabin Canyon we took *Scymnus ardelio* Horn, *Hippodamia convergens* Guerin, *Thalassa montezumæ* Mulsant, *Cryptorhopalum pumilum* Casey, *Chauliognathus profundus* Le Conte, and *C. obscurus* Schæffer, *Enoclerus abruptus* Le Conte, a species of *Hydnocera*, *Hymenorus rotundicollis* Casey, and *Epitragus fusiformis* Casey. This last mentioned species and the *Chauliognathus profundus* were very common on many plants.

Three species of Bruchus were found at the nectar in Stone Cabin Canyon,*Bruchis impiger* Horn, *B. amicus* Horn and *B. chiricahuæ* Fall. In Pima Canyon *Bruchus crenatus* Schæffer was collected.

Among the visitors at the nectar in Stone Cabin Canyon were three species of weevils, *Cyphus lautus* Le Conte, *Coleocerus dispar* Horn and *Læmosaccus texanus* Schæffer.

The Hymenoptera were abundant visitors at the nectaries and pollen. The bees have been determined by Messrs. Cockerell and Crawford, the ants by Dr. W. M. Wheeler, the wasps by Mr. Rohwer.

The ants were constant visitors on the plants. The following species were taken; *Myrmecocystus melliger* Forel, subsp. *orbiceps* Wheeler, *Formica rufibarbis* Fabricius var. *gnava* Buckley, *Cremastogaster opaca* Mayr var., *Camponotus bruesi* Wheeler, *Camponotus fallax* Nylander var., *Camponotus mina* Forel. subsp. *zuni* Wheeler var., and two species of *Pheidole.*

Among the bees were *Melissodes communis* Cresson and *Perdita mentzeliarum* Ckll. and a new species in each of these genera, and *Halictus mesillensis* Ckll. Professor Cockerell's notes follow this paper.

Mr. Crawford has determined the chalcids and finds seven species probably all undescribed. Two of these he presents in an accompanying paper. The yellow *Spilochalcis* and the *Chalcura* have already been mentioned. A beautiful black *Spilochalcis* was also taken in Stone Cabin Canyon, and in this same locality was found a species of *Habrocytus.* In Fish Creek Canyon we found a new species of *Perilampus*, a *Conura*, and a new species of *Rileya*, described in the accompanying paper.

Mr. Rohwer has determined the wasps to be a new species of *Tiphia*, two species of *Paratyphia*, and has also determined a Braconid of the genus *Monogonogastra.* A specimen of *Polistes bellicosus* Cresson was taken at nectar and was found to be parasitized by a *Xenos.*

Outside of two notices of the boll weevil on *Thurberia*[1] this is the first paper in which any insects are recorded from the plant. It is therefore of interest to note that this paper mentions 83 different species in 8 orders of Insecta and one of Acarina. The species are distributed as follows, Acarina 1, Hemiptera 14, Orthoptera 3, Thysanoptera 2, Lepidoptera 7, Coleoptera 24, Hymenoptera 29, Diptera 2, and Strepisptera 1.

These insects may be classed as injurious 25, nectar visiting 40, parasitic 12, and predaceous 6, in their purposes of visiting the plant.

STUDIES OF THE ARIZONA THURBERIA WEEVIL ON COTTON IN TEXAS.

By B. R. Coad and W. D. Pierce, *Bureau of Entomology.*

In order to establish the taxonomic status of the weevil breeding in Arizona in the squares and bolls of *Thurberia thespesioides* a number of studies have been undertaken. In connection with these studies individuals of both sexes of the Arizona and Texas

[1] Cook, 1913, Science, February, 1913.
Pierce, 1913, The occurrence of cotton boll weevil in Arizona, Journ. Agr. Research, I, no. 2, pp. 89–96, pl. VI.

varieties were taken to Stockholm, Sweden, by Mr. A. N. Caudell, and compared with the type of *Anthonomus grandis*. On account of Mr. Caudell's careful comparison the usual form of this species, known as the Mexican cotton boll weevil, must be known as *Anthonomus grandis grandis* Boheman and the Arizona wild cotton, or Thurberia weevil, as *Anthonomus grandis thurberiæ* Pierce.[1]

The experiments described in this paper have been carried out along several different lines. The principal results have been the ascertaining of the ability of the two varieties to interbreed and produce fertile offspring, and the working out of the developmental period for certain seasons of the year.

The first weevils were obtained from the Santa Rita Mountains, Arizona, in May, 1913, and were extracted from their cells in the Thurberia bolls, at Washington about May 15, and then shipped with fresh Hibiscus foliage to Victoria, Tex., where they were received May 20. A second sending was received from the same locality in Arizona about September 1.

The weevils extracted in May were divided into three lots, the first being male and female *thurberiæ*, the second *thurberiæ* females placed with *grandis* males, the third *grandis* females placed with *thurberiæ* males.

Three pairs of typical *thurberiæ* were placed on cotton but they did not take readily to the new food plant. Only eight eggs were deposited and these by a single pair. From the eight eggs just two weevils matured. The period of development was 19 days, identical with that for typical *grandis* at that season. In 83 weevil-feeding days, 60 feeding punctures were made, or 0.7 per day with 3 the maximum. In 30 weevil-oviposition days, only 8 eggs were laid, or 0.2 per day.

Inasmuch as the *thurberiæ* individuals received in May were together, there was a possibility of fertilization. They had just been extracted from their hibernation cells and had not fed when received at Victoria. In the experiment with female *thurberiæ* and male *grandis* no eggs were laid by either female until June 2, 12 days after being placed with the *grandis* males. Copulation was observed in one pair on the second day of the experiment. Each pair was actually observed in copula three times and the actual number of copulations was probably considerably greater. In 161 weevil-feeding days, 461 feeding punctures were made, with the average per individual 2.8 per day. In 64 weevil-oviposition days 245 eggs were laid, with an average of 3.8 per day and a maximum of 10. Eggs were obtained from June 2 to July 3 from these two females. The offspring were bred from June 26

[1] Journ. Agric. Research, vol. I, no. 2, November, 1913.

to July 16. The average period of development to maturity ranged from 16 days from eggs laid June 6 to 12.4 days from eggs laid June 26. The offspring numbered 20 males and 20 females.

In the third series the males of *thurberiæ* were placed with hibernated females of *grandis* collected in the field. These females were already fertile as they began oviposition almost immediately. In 200 weevil-feeding days, 454 feeding punctures were made, with the average per individual 2.2 per day. In 94 weevil-oviposition days 717 eggs were laid with the average 7.6 eggs per day and a maximum of 16. Eggs were obtained from May 22 to July 7. The offspring were bred from June to July 20. The average period of development to maturity ranged from 20 days for eggs laid May 28 to 12 days for eggs laid June 6. The offspring numbered 137 females and 145 males.

The weevils with the female *thurberiæ* strain in the second series averaged day for day a fraction of a day shorter developmental period than the offspring of the female *grandis* which may have had a male *thurberiæ* strain in the latter part of the experiment.

The offspring of the male *grandis*, female *thurberiæ* breedings were interbred. In 22 weevil-oviposition days 179 eggs were laid, with an average of 8.1 per day and a maximum of 15. Eggs were obtained from July 2 to 17 and the offspring were bred from July 16 to 28. The average period of development to maturity ranged from 15 days for eggs laid July 3, to 11 days for eggs laid July 15. The offspring numbered 12 females and 20 males.

The offspring of the male *thurberiæ*, female *grandis* breedings were interbred. In 72 weevil-oviposition days, 253 eggs were laid, with an average of 3.5 per day and a maximum of 15. Eggs were obtained from June 24 to July 11 and the offspring were bred from July 7 to 22. The average period of development to maturity ranged from 11 to 18 days. The offspring numbered 32 females and 25 males.

A comparison of average development dating from 5 day oviposition periods is available in five combinations for July 1 to 5. The offspring of native *grandis* took 12.1 days; of female *grandis* by male *thurberiæ* 12.4 days; and of the male and female offspring of the female *grandis*, male *thurberiæ* combination 14.9 days; of female *thurberiæ* by male *grandis* 12.6 days; and of the male and female offspring of the female *thurberiæ*, male *grandis* combination 14.2 days. The accompanying table (Table I) gives the complete record.

In September more material was received from Arizona. Complete studies of this material have not been made but the following results have already been obtained (see Table II).

TABLE I. *Summary of average development from 5-day oviposition periods.*

Date of oviposition	Developmental period from eggs deposited by					
	Typical *grandis*	Male *thurberiæ* female *grandis*	Male *thurberiæ* female *grandis*	Typical *thurberiæ*	Male *grandis* female *thurberiæ*	Male *grandis* female *thurberiæ*
	days	*days*	*days*	*days*	*days*	*days*
May 27–31......		17.6		19		
June 1–5........		15.8				
June 6–10.......	15.7	16.0			16.0	
June 11–15......	15.2	14.9			13.8	
June 16–20......	14.8	12.4			14.5	
June 21–25......	14.2	12.6	13.0		13.4	
June 26–30......	14.4	12.4	13.0		12.4	
July 1–5........	12.1	12.4	14.9		12.6	14.2
July 6–10........		12.4	14.0			14.3
July 11–15.......						13.8
Weighted average	14.4	14.4	13.6	19	13.3	14.3

TABLE II. *Summary of average development from eggs laid on same day.*

Date of oviposition	Developmental period from eggs deposited by			
	Typical *grandis*	Typical *thurberiæ*	Male *grandis* female *thurberiæ*	Male *thurberiæ* female *grandis*
September 2....................	16.5	16		
September 3....................	15.6	18		
September 4....................	15.0	17		
September 5....................	18.0	19		18
September 6....................		16		
September 7....................	20.5	16	18.5	
September 8....................	18.0	17		
September 9....................	20.0		18.6	
September 10....................		19		19.5
September 11....................				19.7
Average........................	17.9	17.2	18.5	19.0

[redacted]

Male *grandis* were placed with female *thurberiæ* which were isolated when extracted from their 1912 pupal cells in the latter part of August. The three females thus used began oviposition in 2, 2 and 4 days after being placed with the males on cotton squares. During the month of September they deposited 87, 92 and 137 eggs each, with an average of 3.5 eggs per female per day. The developmental period of the progeny determined up to October 1 averaged 18.5 days for 4 males and 3 females, all unusually small.

Male *thurberiæ* were placed with known infertile female *grandis* and these deposited, during September, 79 and 25 eggs each, with an average of 1.9 eggs per female per day. The developmental period of the progeny determined to October 1 averaged 19 days for 5 females and 5 males.

Typical *thurberiæ* pairs were placed on cotton squares and bolls. The development in bolls has not yet been determined but is successful. On squares the females deposited during September, 71, 71, 90 and 171 eggs each, with an average of 4.5 eggs per female per day, which was better than the average in either cross. The developmental period of the progeny determined to October 1 averaged 17.2 days for 7 females and 12 males.

——In discussing the two preceding papers Mr. Hunter referred to the biological and possible economic importance of the observations that had been made.

It has been known for a long time that the principal barrier the cotton boll weevil encounters in the United States is dryness of climate. This has prevented the invasion of important cotton producing areas in western Texas. The Arizona weevil has evidently acquired an ability to withstand such conditions. This is a strong indication of the plasticity of the species. Another indication of this is the fact that the Arizona weevils adapted themselves perfectly to the conditions of the humid country at Victoria, Texas, as soon as they were transported to that place, and is further evidenced by the ready change from *Thurberia* to cotton when transported to a new region.

The ability of the Arizona weevil to maintain itself in the face of extremely arid conditions shows its possible great economic importance. If it should by accident, or otherwise, be established in the arid country of western Texas it would probably maintain itself. If this should happen there would be a continuous

infestation of the cotton belt by weevils from the extreme west to the east. In this way the production in western Texas which has been generally considered to be sufficient to offset any great reduction of the crop in the eastern part of the belt on account of the ravages of the weevil could not be depended upon. This consideration is of special importance on account of the fact that production in the western part of the belt has been considered sufficient to enable the United States to continue its supremacy in cotton production regardless of an extensive falling off in production elsewhere.

——Dr. Hopkins stated that the fact that the two forms interbreed in confinement is not sufficient evidence that they are the same species. If they are the same, they should be included under the name *grandis*; otherwise the Arizona form should be designated as a species under a new name.

He entered a protest against trinomials for so called varieties and sub-species, arguing that if a form can be readily recognized it should be considered a species as long as it can be so distinguished. If it should enter the range of an allied species from which it cannot be readily separated, the prior name should be applied to both.

It seemed to him that if the Arizona form becomes established in the *grandis* area and inter-breeds in nature, they should both, including varieties, come under the name *grandis*, but as long as the Arizona form is restricted to its present known area, it should be recognized as a good species under the name *thurberiæ*.

——Dr. Howard referred to the observations mentioned by Mr. Pierce, of the oviposition of *Chalcura* in the flowers of *Thurberia*. The only Eucharid whose life history is known is a parasite of ants; hence, the oviposition of *Chalcura* in the flowers of wild cotton is a puzzle. Inasmuch, however, as *Orasema* has been shown by Wheeler to have a hypermetamorphosis, and as *Perilampus* of an allied family has been shown by Harry Smith also to undergo a hypermetamorphosis, the speaker suggested that in all probability *Chalcura* may eventually be shown to have an active larva of the first stage which will be capable of attaching itself to bees frequenting the wild cotton flowers and thus be carried to their nests where it will attack their larvæ.

[redacted]

——Mr. Hood stated that the thrips taken by Mr. Pierce on *Thurberia* should be known as *Frankliniella insularis* (Franklin), and that the genus *Euthrips* Targioni-Tozzetti, in which it had been placed, is used by the best workers in the stead of *Anaphothrips* Uzel. In addition to the localities mentioned, *Frankliniella insularis* has been recorded in the literature from Brownsville, Texas (Russell, Proc. Ent. Soc. Wash., vol. xiv, p. 128; 1912); Monterey, Mexico; and Miraflores, Canal Zone, Panama (Hood, Psyche, vol. xx, p. 119, 1913). It has also been taken at Georgetown, British Guiana, by Messrs. G. E. Bodkin and L. D. Cleare, and has been found by Mr. Alex. Wetmore in the stomach of a Green Mango Humming Bird (*Anthracothorax viridis*), taken at Utuado, Porto Rico (Biological Survey, No. 105072).

TWO NEW PARASITIC HYMENOPTERA FROM ARIZONA.

BY J. C. CRAWFORD, *U. S. National Museum.*

Rileya piercei n. sp.

Male. Length about 2 mm. Black, with the femora except tips black and a broad annulus on hind tibiæ, brown; sculpture about as in *R. cecidomyiæ* but the second abdominal segment occupying most of abdomen. In *cecidomyiæ* the first and second are short and the third and fourth are almost subequal in length.

Described from one specimen collected on *Thurberia thespesioides*, August 19, 1913, at Fish Creek, Arizona, by Mr. W. D. Pierce, after whom the species is named.

Type: Cat. No. 16701, U. S. N. M.

Chalcura arizonensis n. sp.

Female. Length about 3 mm. Black, with the sculpture about as in *C. gibbosa* Prov. but the dentation on the second joint of the funicle as long as on the first; pedicel concolorous with the funicle instead of light; the transverse rugæ at the inner edge of the lateral lobes of mesoscutum extending on to the shiny disks and these rugæ not so greatly elevated as in *gibbosa*.

Described from one specimen collected by Mr. W. D. Pierce in Stone Cabin Canyon, Santa Rita Mountains, Arizona, August 25, 1913, and with the additional record "ovipositing in bud of *Thurberia thespesioides*."

Type: Cat. No. 16702 U. S. N. M.

TWO MICROLEPIDOPTERA ON THURBERIA THESPESIOIDES.

By August Busck, *Bureau of Entomology.*

Dichomeris deflecta Busck, Proc. Ent. Soc. Wash., vol. XI, p. 91, 1909.

This peculiar species was described from a single specimen from Arizona. The very long, porrected, compressed palpi with the short, deflected terminal joint are unlike those of any other species in the genus, but this is a difference of degree rather than of kind. The species is otherwise typical of the genus *Dichomeris* and is properly included therein.

The larva is a leaf-folder on *Thurberia thespesioides* and was bred by Mr. W. D. Pierce, at Santa Catalina Mountains, Arizona. The imago issued August 24, 1913. The following is a description of the larva.

Head and first thoracic segment dark reddish brown; eyes and mouth parts black; anal plate large, black, with long black bristles. Remainder of the body white, with four straight, longitudinal rows of large, round, black tubercles, two dorsal and two lateral. There are two such tubercles on each segment in each row, and on account of their size, they are nearly confluent longitudinally. Between these rows of tubercles run a central and two lateral, thin, purplish, longitudinal lines. Below the lateral rows of tubercles each abdominal segment has two more, smaller, oval, brown tubercles, set obliquely. Each tubercle bears a single long, light colored hair. Thoracic feet black, prolegs white, each with an anterior and a posterior row of long brown hooks.

Bucculatrix thurberiella n. sp.

Face tuft, head and thorax white. Antennæ white with dark fuscous annulations. Forewings white; extreme costal edge blackish; an outwardly black streak beyond the middle of costa is continued as a very fine, easily lost line across the wing to a group of black scales below apex, where the cilia is also dotted with black; a few easily lost black scales on basal third of dorsum and a group of black scales on the middle of dorsum is followed by scattered light brown scales. The apical part of the wing above the oblique costal streak is dusted with brown and black scales. Cilia ochreous white. Hind wing and cilia ochreous white. Legs white on the inner side, black exteriorly; tarsi black with narrow white annulations. Alar expanse: 7 to 8 mm.

Habitat: Santa Catalina Mountains, Arizona.

Type: No. 16699, U. S. N. M.

Bred by Mr. Pierce from *Thurberia thespesioides*, in August and September.

The larva is dirty white, rough skinned, with prominent, white

[redacted]

tubercles and with two dorsal rows of black dots, one on each segment. Head light ochreous with black eye spots and reddish brown mouth parts.

Cocoon ribbed, typical of the genus, pearly white, length 8–9 mm.

BEES VISITING THURBERIA.

By T. D. A. Cockerell.

In August, 1913, Mr. W. D. Pierce collected bees from the flowers of *Thurberia thespesioides* Gray, in Stone Cabin Canyon, Santa Rita Mountains, Arizona. This plant, given in the Synoptical Flora as a synonym of *Ingenhouzia triloba* D. C., is so near to *Gossypium* that it was once described under that generic name. On this account any insects frequenting it are of more than ordinary interest. The bees collected are as follows:

Melissodes thurberiæ n. sp.

Female. Closely allied to and resembling *M. thelypodii* Ckll., to which it runs in my table in Trans. Amer. Ent. Society, 1906. It differs from *thelypodii* by the pale hair of thorax above (which agrees in character and arrangement with that of *M. martini*, except that there is no black hair); the wings darker and redder; the tegulæ piceous, with the posterior margin broadly ferruginous; scutellum with a slight median longitudinal ridge.

The disc of mesothorax has considerably smaller and closer punctures than *M. martini* Ckll., and they run principally in transverse lines. The same characters, and the dark tegulæ, readily distinguish it from *M. hitei* Ckll.. Although the hair of thorax above is creamy white, there is a little orange tuft on base of wings. White hair appears at extreme sides of fifth abdominal segment, whereas in *M. hitei* the hair in this place is black. Head very broad; vertex in type with only one dark hair. Length of anterior wing 11½ mm.

Type: Cat. No. 16845, U. S. N. M., Collected on August 26.

Melissodes communis Cresson.

Female. Differs from a cotype by smaller size, and darker stigma and nervures. The single specimen is in bad condition; probably a series, well preserved, would indicate a distinct subspecies. Collected August 25.

Perdita mentzeliarum Ckll.

I cannot distinguish these from the variable species *P. mentzeliarum*, which usually visits *Nuttalia* (*Mentzelia* Auctt.). Perhaps they are strays from adjacent *Nuttalia* flowers. Two female specimens August 27.

Perdita punctifera n. sp.

Female. Runs in my table in Proc. Phila. Acad., 1896, to *P. mentzeliæ* Ckll., to which it is nearly related, differing by the white lateral face marks being longer, and sharply pointed above, though notched on inner side (they are like those of *P. pallidior* Ckll.); the clypeus with a small white spot, more or less distinctly triangular, on its upper margin; the light color of the antennæ creamy-white instead of yellow. From *P. pallidior* it is easily known by the heavily banded abdomen and largely darkened legs, both characters being as in *mentzeliæ.*

Type: Cat. No. 16844, U. S. N. M. Three specimens collected on August 27.

Certainly this insect is very close to *P. mentzeliæ*, and from its combination of characters one might suppose it to be a hybrid, *mentzeliæ* × *pallidior*, were those species present. Further investigation of the series of species to which this belongs will, I believe, elicit some facts of great interest. The differential characters may behave in a Mendelian manner in hybrids, and some of the apparently distinct species may represent the results of earlier crosses.

The Thurberia bees certainly do not show any great degree of modification or specialization. The impression gained is that *Thurberia* may have entered the region within comparatively recent times, its bee-fauna being apparently in the earliest stages of differentiation. It is singular that we do not find the bees which habitually occur on other Malvaceæ in the southwest.

——In connection with the papers on the Thurberia weevil Mr. Barber spoke of two of his breeding experiments and has furnished the following abstract of his remarks.

ON INTERSPECIFIC MATING IN PHENGODES AND INBREEDING IN EROS. (COLEOPTERA.)

By Herbert S. Barber, *Bureau of Entomology.*

The results of an experiment started in 1912 show some contrast to the results of Messrs. Coad and Pierce in interbreeding the Thurberia and Cotton Boll Weevils, but the writer does not believe that the mere interbreeding of forms proves their specific identity. A few females of a species of *Phengodes* were received through Mr. Charles Schæffer from Long Island, and there being no males of the same species at hand were confined with males of our local species *P. laticollis.* The two species appear to live in different types of

country, and to be easily distinguished in the male, female and larval stages. Several males were confined, one after the other, with each female. Usually, when a male *laticollis* is introduced into a jar with a female of its own species, mating occurs very quickly, but with the females of this other species most of the males failed to recognize the female, and only in a few instances displayed sexual excitement, which was of short duration except in two cases. One of these males attempted copulation a few times without success, while the other succeeded after many fruitless attempts, but displayed great difficulty in disengaging himself afterward. This female that had been fertilized laid eggs in due time. The other was restless and abnormal in actions, but laid three infertile eggs, and finally died. All the other females died without laying eggs. Of the 48 eggs laid by the fertilized female, many were infertile. In others the embryo developed but failed to issue, and only ten larvæ hatched. Of these most were very badly deformed and unable to feed. Two of them, however, fed and have lived fifteen months in confinement. They display the specific characters of the male parent. It appears from the above that in addition to the isolation of the two species by habitat the species are separated by (1) lack of sexual attraction, (2) mechanical difficulty in copulation, and (3) in some manner the fertilization is faulty and results in gross abnormalities. The writer believes that these two forms are very distinct species, but that chance migration of the males may, very rarely, result in interspecific unions, with a slight chance of the survival of hybrid offspring which would naturally be reabsorbed in the local species if it should prove to be fertile.

The question of sexual attraction even within a single species is in itself a very interesting and important question. We are, of course, utterly unable to detect the difference in odors or other factors by which one sex recognizes the opposite sex of its own kind, and is stimulted to sexual excitement while with another species the stimulus may be absent or repulsive. Some groups are sexually mature as soon as they have hardened after issuance from the pupa, and mate with their own brothers or sisters, but most appear to have some obstacle that prevents breeding. The first group are usually somewhat degraded and are inclined to form numerous local races or color forms. An example of this group is *Eros humeralis* of which the following brief observation is significant:

From a colony of larvæ found last spring (1913) in a rotten sycamore log, the individuals were isolated in plaster cells where they pupated and matured. The adults showed no desire for migration but lay quiet in the cells. A male was introduced into a cell

with a female and immediately mated. Next day he was placed with another female and immediately mated. Both females deposited eggs, and the young began feeding in the wood, but the female parents at no time displayed a desire for a migration flight. It is believed the colony was originally from a single set of eggs and that more than two generations would have been passed within the log in nature.

In the second group the "provisions" against, or obstacles to inbreeding assume varied forms. Usually the ratio chance of unions between brothers and sisters to unions between unrelated individuals, is so low that the offspring would be quickly reabsorbed into the normal form, but the details of habit that control this low percentage may be varied. Chief of these is the instinct for migration, which appears to precede sexual maturity in many social insects, but there appears to be also a remarkable difference in time of development of the opposite sexes among the progeny of a single parent of some species. The writer believes from preliminary experiments, that in *Phengodes* the males develop after two years in the larval stage, while their sisters must spend three or more years as larvæ. In this genus the males are strong migrants while the females must lay their eggs where they have transformed. The writer has shown that in *Micromalthus* the males issue about two weeks after their sisters are out, but subsequent observations indicate that males issue abnormally or irregularly at times. Attempts to mate specimens from different colonies in the breeding cells all failed, and as both males and females manifested only a desire to migrate from the time of their issuance almost until death, it is believed sexual maturity will develop only after such migratory flight.

ON THE PROPER GENERIC NAMES FOR CERTAIN THYSANOPTERA OF ECONOMIC IMPORTANCE.

By J. Douglas Hood, *United States Biological Survey.*

The tobacco thrips, the pear thrips, and the orange thrips—species responsible in the United States for damage amounting to many thousands of dollars every year and each the subject of several published accounts—are at present wrongly placed in the genus *Euthrips* Targioni-Tozzetti by all North American workers. The purpose of this paper is to correct the generic positions of these and other allied species and to direct attention to several papers which have been overlooked in America, that the proper names for these insects may be used in the rapidly-growing economic literature.

To this end the present account is divided into three parts: first, a brief, general discussion of the nomenclature of the several groups of species which have masqueraded under the name *Euthrips*; second, a catalogue of the American components of the genera to which these species, in the light of our present knowledge, actually belong; and, third, a bibliography of all papers necessary to a proper study of these problems. To the papers by Buffa (1907) and Karny (1912) I am particularly indebted for many of the points brought out below.

Probably no other genus of Thysanoptera has presented more difficult questions of nomenclature, nor disclosed more diverse opinions regarding its proper application, than the genus *Euthrips* Targioni-Tozzetti. It was proposed in 1881 as a substitute for the name *Thrips* which has been used by Haliday (1836) for a subgenus of *Thrips* Linné (1758),—evidently for no better reason than to avoid the duplication of the generic name in a subgenus. Haliday divided Linné's genus *Thrips* into the five subgenera, *Aptinothrips*, *Chirothrips*, *Limothrips*, *Belothrips*, and *Thrips* s.s., of which the first four were new. Targioni-Tozzetti accepted the division of the genus into five subgenera and, except for a few slight changes, reproduced Haliday's key in Italian. The only important change was the employment of the subgeneric name *Euthrips* in the place of *Thrips*. That he proposed *Euthrips* in the sense of *Thrips* s. s., is shown by: (1) its derivation (from εὐ, *true* or *well* + θρίψ); (2) the placing of *Thrips* in its synonymy in two places; (3) the fact that he does not use the subgeneric name *Thrips*; and (4) the inclusion in *Euthrips* of the species which Haliday assigned to the subgenus *Thrips*. This suppression of the subgenus *Thrips* is in direct opposition to Article 9 of the International Code of Zoological Nomenclature, which reads as follows: "If a genus is divided into subgenera, the name of the typical subgenus must be the same as the name of the genus." Article 31 of the Entomological Code (Banks and Caudell, 1912) is equally explicit. It is evident, therefore, that *Euthrips* Targioni-Tozzetti (1881) is an absolute synonym of the genus *Thrips* Linné (1758), and isogenotypic therewith.[1] *Euthrips, therefore, can never be used as a generic name in zoology.*

Karny (1912) and Buffa (1907), by a different course of reasoning, retain *Euthrips* as a valid generic name, and use it in the place of *Anaphothrips* Uzel. According to them, the type of *Euthrips* must be chosen from one of its three originally included species. This contention I have shown to be at fault, for the name was erected as a substitute for a perfectly valid older name which was

[1] The type of *Thrips* Linné (1758) was designated as *T. physapus* L. by Westwood in 1840.

cited in its synonymy. *Anaphothrips* is thus restored in the sense of *Euthrips*, Karny (nec Targioni-Tozzetti), and its type hereby designated as *Thrips obscura* Müller (=*Thrips striata* Osborn=*Anaphothrips virgo* Uzel).

In the place of *Euthrips* the European workers for many years used the name *Physapus* De Geer (or *Physopus*, as emended by Uzel). This name was first used by De Geer in 1744, before the appearance of Linné's Systema Naturæ, and is thus without standing in zoological nomenclature. In 1773 De Geer cited his earlier paper, but accepted Linné's name *Thrips* (1758). Hence the name *Physapus* can not date from this use by De Geer in 1773. Opinion 5, rendered by the International Commission on Zoological Nomenclature, covers this point in the following words: "A pre-Linnæan name, ineligible because of its publication prior to 1758, does not become eligible simply by being cited or reprinted with its original diagnosis after 1757. To become eligible under the Code, such names must be reinforced by adoption or acceptance by the author publishing the reprint." A ruling to this effect is also incorporated in the Entomological Code. *Physapus*, then, must date from its definition by Amyot and Serville in 1843, this being its first adoption in literature subsequent to 1758. The name is preempted, however, by *Physapus* Leach (1830?,see Bibliography), a genus of Ephemerida. *Physopus*, Uzel (1895), is also unavailable, being simply an emended spelling of the older name. *Physapus, therefore, can not be used as a generic name in Thysanoptera.*

The literature previous to 1907 furnishes only two names that may be used for the mutually homogeneous segregates of this old genus *Physapus* (=*Euthrips*, auctores, nec Targioni-Tozzetti). These are *Tæniothrips* Amyot et Serville (type, *Thrips primulæ* Haliday) and *Odontothrips* Amyot et Serville (type, *Thrips phalerata* Haliday), both erected in 1843.

To the former of these belongs *Euthrips pyri* Daniel, the pear thrips. It is positively congeneric with *T. primulæ* (Haliday), and even under the microscope might easily be mistaken for that species. *Primulæ* differs from *pyri* principally in that the apical antennal segments are much more slender and the anterior vein of the fore wings is set with three spines, instead of five, in its apical half.

To *Odontothrips* must be assigned two North American species commonly listed in *Euthrips*. These are *Euthrips ulicis californicus* Moulton, described as a variety of Haliday's *Thrips ulicis*; and *Thrips phalerata* Haliday, recently recorded by Morgan (1913) from Florida under the name *Euthrips phalerata*.

This disposes of three of the twenty-two species of "*Euthrips*" recorded from North America. Of the remainder, one, *Euthrips*

citri Moulton, the orange thrips, belongs in the genus *Scirtothrips* Shull (1909). This genus was compared at the time of its original description with *Anaphothrips* Uzel, to which, however, it is not at all closely related. The most casual observation under high magnification shows the thorax of all the known species to be finely and closely transversely striate and the abdomen to be clothed more or less completely with minute, hair-like, chitinous processes. These characters ally it rather closely to *Sericothrips* Haliday, from which it differs notably in the more sparsely spinose anterior vein of the fore wing. As in *Sericothrips*, the species are active jumpers, and in life or when mounted dry have a dull, silky luster. To *Scirtothrips*, therefore, in addition to the type species *ruthveni* Shull and *S. niveus* Hood, must be assigned *Euthrips citri* Moulton (the orange thrips), *Euthrips longipennis* Bagnall (=*Euthrips parvus* Moulton), *Anaphothrips albus* Jones, and a sixth species whose description by the writer will probably appear elsewhere before the publication of the present paper.

Thirteen additional species, all but two of which were described in *Euthrips* by American authors, really belong with *Frankliniella stylosa* Hood in the genus *Frankliniella* Karny (1910), which was erected at the instance of Franklin (1908) as a substitute for *Physapus*, Karny (nec Amyot et Serville). As the type of this genus has never been fixed, I hereby designate *Thrips intonsa* Trybom (=*Physopus vulgatissima*, Uzel, nec Haliday) as the genotype. The North American species belonging here are enumerated in the catalogue below.

The five remaining species (*Euthrips albus*, *E. ehrhornii*, and *E. orchidii*, Moulton; and *E. costalis* and *E. longirostrum*, Jones) may all be placed for the present at least, in *Physothrips* Karny (1912). Only one of these, *Euthrips orchidii* Moulton, is in the material before me; it seems to be congeneric with *Physothrips ulmifoliorum* (Haliday), the type of genus.

CATALOGUE.

No attempt has been made to cite every reference to the several species, only those being given which are of especial interest to the taxonomist.

FRANKLINIELLA Karny, 1910.

Thrips, *Physapus*, *Physopus*, and *Euthrips*, auct.

Frankliniella Karny, Mitteil. Naturw. Ver. Univ. Wien, Jahrg. VIII, p. 46 (type, *Thrips intonsa* Trybom, = *Physopus vulgatissima*, Uzel, nec Haliday, herein designated).

1. ***bispinosa*** (Morgan); *Euthrips tritici* var. *bispinosus* Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 10, figs. 17-18.

2. *cephalica* (Crawford); ***Euthrips cephalicus*** Crawford, Pomona Coll. Journ. Ent., vol. ii, 1910, p. 153, fig. 63, A–H; ***Frankliniella cephalica***, Karny, Zool. Ann., vol. iv, 1912, p. 335.
3. *floridense* (Morgan); ***Euthrips floridensis*** Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 5, figs. 9–12.
4. *fusca* (Hinds); ***Euthrips fuscus*** Hinds, Proc. U. S. Nat. Mus., vol. xxvi, 1902, p. 154, pl. iv, figs. 40, 41; ***Euthrips nicotianæ*** Hinds, Proc. Biol. Soc. Wash., vol. xviii, 1905, p. 198; ***Frankliniella fusca,*** Karny, Zool. Ann., vol. iv, 1912, p. 335; *F. nicotianæ*, idem, ibidem, p. 336.
5. *gossypii* (Morgan); ***Euthrips gossypii*** Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 9, figs. 19–22.
6. *helianthi* (Moulton); ***Euthrips helianthi*** Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 40, pl. iv, figs. 26–29; ***F.*** [*ranklinella*] *helianthi*, Karny, Zool. Ann., vol. iv, 1912, p. 336.
7. *insularis* (Franklin); ***Euthrips insularis*** Franklin, Proc. U. S. Nat. Mus., vol. xxxiii, 1908, p. 715, pl. lxiii, figs. 1–3, 5–7, pl. lxv, figs. 19, 24; ***Euthrips insularis*** var. *reticulata* Crawford, Pomona Coll. Journ. Ent., vol. i, 1909, p. 116 (a worthless variety); ***Frankliniella insularis***, Karny, Zool. Ann., vol. iv, 1912, p. 334.
8. *minuta* (Moulton); ***Euthrips minutus*** Moulton, Tech. Ser. No. 12, Pt. iii, Bur. Ent., U. S. Dept. Agr., 1907, p. 56, pl. iv, figs. 32, 33; ***Euthrips minutus*** var. *setosus* Crawford, Pomona Coll. Journ., Ent., vol. i, 1909, p. 105, fig. 47, A–G (a worthless variety); ***Frankliniella minuta***, Karny, Zool. Ann., vol. iv, 1912, p. 335.
9. *tritici* var. **moultoni, nom. nov.**; ***Euthrips tritici californicus*** Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 28; preempted[1] by *Euthrips ulicis californicus* Moulton, 1907, = *Odontothrips ulicis californicus* (Moulton).
10. *nervosa* (Uzel); *Physopus nervosa* Uzel, Mon. d. Ordn. Thys., 1895, p. 102; *Thrips* (*Euthrips*) *maidis* Beach, Proc. Iowa Acad. Sci., vol. iii, 1896, p. 219; *Frankliniella nervosa,* Karny, Zool. Ann., vol. iv, 1912, p. 335.
11. *occidentalis* (Pergande); ***Euthrips occidentalis*** Pergande, Ins. Life., vol. vii, 1895, p. 392; *Frankliniella occidentalis*, Zoöl. Ann., vol. iv, 1912, p. 335.
12. *runneri* (Morgan); ***Euthrips runneri*** Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 7, figs. 13-16.

[1] "Specific and subspecific names are subject to the same rules and recommendations, and from a nomenclatorial standpoint they are coordinate—that is, they are of the same value." (Article 11, International Code.) *Euthrips ulicis californicus* and *E. triciti californicus*, though both originally described as varieties, were written as trinomials, and thus brought within the scope of the above rule. The Entomological Code is more sweeping, specifying in Section 37 that, "In species, subspecies, varieties, or races, the same name shall not be used twice in the same genus."

13. *stylosa* Hood, Proc. Ent. Soc. Wash., vol. XIV, 1912, p. 134, pl. V, fig. 7.
14. *tritici* (Fitch); *Thrips tritici* Fitch, Country Gentleman, vol. VI, 1855, p. 385, figs. a–g; *Frankliniella tritici*, Karny, Zool. Ann., vol. IV, 1912, p. 335.

PHYSOTHRIPS Karny, 1912.

Thrips, Physapus, Physopus, and *Euthrips*, auct.
Physothrips Karny, Zool. Ann., vol. IV, 1912, p. 336 (type, *Thrips ulmifoliorum* Haliday, by designation).

1. *albus* (Moulton); *Euthrips albus* Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 39, pl. III, figs. 20–22, pl. IV, fig. 30; [*Physothrips*] *albus*, Karny, Zool. Ann., vol. IV, 1912, p. 340.
2. *costalis* (Jones); *Euthrips costalis* Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 13, pl. IV, figs. 1–4; [*Physothrips*] *costalis*, Karny, Zool. Ann., vol. IV, 1912, p. 344.
3. *ehrhornii* (Moulton); *Euthrips ehrhornii* Moulton, Tech. Ser. No. 12, Pt. III, Bur. Ent., U. S. Dept. Agr., 1907, p. 54, pl. III, figs. 25, 26; *Euthrips ehrhornii*, Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 12 (description of male); *Physothrips ehrhornii*, Karny, Zool. Ann., vol. IV, 1912, p. 338.
4. *longirostrum* (Jones); *Euthrips longirostrum* Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 12, pl. III, figs. 6–9; *Physothrips longirostrum*, Karny, Zool. Ann., vol. IV, 1912, p. 344.
5. *orchidii* (Moulton); *Euthrips orchidii* Moulton, Tech. Ser. No. 12, Pt. III, Bur. Ent., U. S. Dept. Agr., 1907, p. 52, pl. II, figs. 15–18; *Physothrips orchidii*, Karny, Zool. Ann., vol. IV, 1912, p. 339.

TÆNIOTHRIPS Amyot et Serville, 1843.

Thrips, Physapus, Physopus, and *Euthrips*, auct.
Tæniothrips Amyot and Serville, Hist. Nat. des Ins., Hémiptères, 1843, p. 644.
———, Karny, Zool. Ann., vol. IV, 1912, p. 340 (type, *Thrips primulæ* Haliday, by designation).

1. *pyri* (Daniel); *Euthrips pyri* Daniel, Ent. News, vol. XV, 1904, p. 294; *Physothrips pyri*, Karny, Zool. Ann., vol. IV, 1912, p. 338.

ODONTOTHRIPS Amyot et Serville, 1843.

Thrips, Physapus, Physopus, and *Euthrips*, auct.
Odontothrips Amyot and Serville, Hist. Nat. des Ins., Hémiptères; 1843 p. 642.
———, Karny, Berl. Ent. Zeitschr., vol. LII, 1907, p. 45 (type *Thrips phalerata* Haliday, by designation).
———, Karny, Zool. Ann., vol. IV, 1912, p. 329.

1. *phaleratus* (Haliday); *Thr.* [*ips*] *phalerata* Haliday, Ent. Mag., vol. III, 1836, p. 447; *O.* [*dontothrips*] *phalerata*, Amyot and Serville, Hist. Nat. des Ins., Hémiptères, 1843, p. 643; *Odontothrips phaleratus*, Karny, Zool. Ann., vol. IV, 1912, p. 329; *Euthrips phalerata*, Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 1, figs. 1–4.
2. *ulicis californicus* (Moulton); *Euthrips ulicis californicus* Moulton, Tech. Ser. No. 12, Pt. III, Bur. Ent., U. S. Dept. Agr., 1907, p. 55, pl. iii, fig. 27, pl. iv, figs. 28–31; *Odontothrips ulicis*, Karny, Zool. Ann., vol. IV, 1912, p. 329.

SCIRTOTHRIPS Shull, 1909.

Scirtothrips Shull, Ent. News, vol. XX, 1909, p. 222 (type, *S. ruthveni* Shull, monobasic).
Anaphothrips (pars), Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 15.
Physothrips (pars), Karny, Zool. Ann., vol. IV, 1912, p. 336.
Scirtothrips (pars), idem, ibidem.

1. *albus* (Jones); *Anaphothrips albus* Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 16, pl. iv, figs. 5–8; [*Scirtothrips*] *albus*, Karny, Zool. Ann., vol. IV, 1912, p. 334.
2. *citri* (Moulton), *Euthrips citri* Moulton, Tech. Ser. No. 12, Pt. VII, Bur. Ent., U. S. Dept. Agr., 1909, p. 121; *Physothrips citri*, Karny, Zool. Ann., vol. IV, 1912, p. 339.
3. *longipennis* (Bagnall); *Euthrips longipennis* Bagnall, Ann. Soc. Ent. Belg., vol. LIII, 1909, p. 173; *Euthrips parvus* Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 38, pl. IV, figs. 23-25.
4. *niveus* Hood, Proc. Biol. Soc. Wash., vol. XXVI, 1913, p. 161.
5. *ruthveni* Shull, Ent. News, vol. XX, 1909, p. 222, figs. 2–4; *Anaphothrips ruthveni*, Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 15.

BIBLIOGRAPHY.

1744 DE GEER, CARL, Beskrifning på en Insect af ett nytt Slågte (Genus,) kallad *Physapus*, Kongl. Swenska. Wetenskaps Academiens Handlingar, vol. V, pp. 1-9, Tab. 1, figs. 1–4. Original description of the genus *Physapus*.

1758 VON LINNÉ, CARL, Systema Naturæ, Regnum Animale, ed. X, p. 457. Original description of the genus *Thrips*.

1773 DE GEER, CARL,. Memoires pour Servir a l'Histoire des Insectes, vol. III, pp. 1–18, pl. I, figs. 1–13. *Physapus* De Geer (1744) cited as a synonym of *Thrips* Linné (1758).

1776 MÜLLER, OTTO FRIEDRICH, Zoologicæ Daniæ Prodromus, seu Animalium Daniæ et Norvegiæ Indigenarum, p. 96. Original description of *Anaphothrips obscurus*.

1830 LEACH, WILLIAM ELFORD, Entomology, The Edinburgh Encyclopædia, vol. IX, pp. 57–172 (Reprint?). The name *Physapus* proposed for a genus of *Ephemerida* on page 137. (Agassiz gives 1817 as the date of erection of *Physapus*, which was copied by Scudder; Hinds gives the following reference in his bibliography, "Leach, W. E., Amer. ed., New Edinburgh Encyclopaedia, $VIII_2$, 1816, p. 715"; other authors give dates ranging from 1814–1817. However, the paper was certainly published prior to 1843, the date of erection of *Physapus* Amyot et Serville.)

1836 HALIDAY, ALEXIS H., An Epitome of the British Genera, in the Order Thysanoptera, with Indications of a few of the Species, Ent. Mag., vol. III, pp. 439–451. The genus *Thrips* divided into five subgenera; original descriptions of *Odontothrips ulicis* and *O. phaleratus*.

1840 WESTWOOD, JOHN OBADIAH, Synopsis of the Genera of British Insects, pp. 1–158 (bound at end of vol. II of An Introduction to the Modern Classification of Insects. *Thrips physapus* L. designated as the type of *Thrips* Linné.

1843 AMYOT, CHARLES JEAN BAPTISTE, and SERVILLE, JEAN GUILLAUME AUDINET, Hist. Nat. des Insectes, Hémiptères, pp. 9 and 637–646. The genus *Physapus* De Geer revived; *Odontothrips* and *Tæniothrips* described as new.

1855 FITCH, ASA, The Wheat Thrips and Three-banded Thrips, Country Gent., vol. VI, pp. 385–386, figs. a–g. Original description of *Frankliniella tritici*.

1881 TARGIONI-TOZZETTI, GIOVANNI, Fisapodi, Annalli di Agricoltura, 1881, No. 34, Parte Scientifica, pp. 120–134, Tav. 3, figs. 14, 15a–15g. The subgenus *Euthrips* erected as a substitute for *Thrips* s.s.

1895 PERGANDE, THEODORE, Observations on Certain Thripidæ, Ins. Life, vol. VII, pp. 390–395. Original description of *Frankliniella occidentalis;* the name *Euthrips* used for the first time in the place of *Physapus*, a course later followed by Hinds.

1895 UZEL, HEINRICH, Monographie der Ordnung Thysanoptera, pp. 1–472, pls. I–X. *Physapus* emended to *Physopus*, with which is united *Tæniothrips* and *Odontothrips; Thrips obscura* Müller redescribed as *Anaphothrips virgo*.

1896 BEACH, ALICE M., Contributions to a Knowledge of the Thripidæ of Iowa, Proc. Iowa Acad. Sci., vol. III, pp. 214–227. Following Pergande the name *Euthrips* used in the sense of *Physapus; Frankliniella nervosa* (Uzel) redescribed as *Thrips* (*Euthrips*) *maidis*.

1902 HINDS, WARREN ELMER, Contribution to a Monograph of the Insects of the Order Thysanoptera Inhabiting North America, Proc. U. S. Nat. Mus., vol. XXVI, pp. 79–242, pls. I–XI. Following Pergande and Beach, the name *Euthrips* is used instead of *Physapus* Amyot et Serville (*Physopus*, Uzel, emend.); original description of *Frankliniella fusca*; *Thrips* (*Euthrips*) *maidis* Beach placed in the synonymy of *Physopus nervosa* Uzel.

1904 Daniel, S. M., New California Thysanoptera, Ent. News, vol. xv, pp. 293–297. Original description of *Tæniothrips pyri*.

1905 Stiles, Charles Wardell, The International Code of Zoological Nomenclature as Applied to Medicine, Bull. No. 24, Hygienic Laboratory, U. S. Treasury Dept., pp. 1–50. The text of the International Code, adopted by the Fifth International Congress (1901, Berlin).

1907 Moulton, Dudley, A Contribution to our Knowledge of the Thysanoptera of California, Tech. Ser. No. 12, Pt. iii, Bur. Ent., U. S. Dept. Agr., pp. i–vi, 39–68, pls. i–vi. A description of the genus "*Euthrips*" (nec Targioni-Tozzetti), with key to Californian species; original descriptions of *Frankliniella minuta*, *Physothrips orchidii*, *Ph. ehrhornii*, and *Odontothrips ulicis californicus*.

1907 Karny, Heinrich, Die Orthopterenfauna des Küstengebietes von Österreich-Ungarn, Berl. Ent. Zeitschr., Bd. lii, pp. 17–52, figs. 1–7 (Thysanoptera, pp. 44–52). The genus *Physopus*, Uzel (nec Amyot et Serville) divided into *Physapus* Serville, *Odontothrips* Serville, *Tæniothrips* Serville, *Euthrips* Targioni-Tozzetti, and *Pezothrips* Karny.

1907 Buffa, Pietro, Trentuna specie di Tisanotteri italiani, Atti d. Soc. Toscana d. Sci. Nat., Mem., vol. xxiii, pp. 1–77, Tav. i, ii. The genus *Euthrips* discussed at length and clearly shown to have no relation whatever to *Physapus* Amyot et Serville.

1908 Franklin, Henry James, On a Collection of Thysanopterous Insects from Barbados and St. Vincent Islands, Proc. U. S. Nat. Mus., vol. xxxiii, pp. 715–730, pls. lxiii–lxv. Original description of *Frankliniella insularis*; the name *Physapus* declared unavailable for a genus of Thysanoptera.

1909 Moulton, Dudley, The Orange Thrips, Tech. Ser. No. 12, Pt. vii, Bur. Ent., U. S. Dept. Agr., pp. i–ii, 119–122, pl. viii. Original description of *Scirtothrips citri*.

1909 Shull, A. Franklin, Some Apparently New Thysanoptera from Michigan, Ent. News, vol. xx, pp. 220–228, figs. 1–7. Original description of *Scirtothrips* and of *S. ruthveni*.

1909 Bagnall, Richard Siddoway, On the Thysanoptera of the Botanical Gardens, Brussels, Ann. Soc. Ent. Belg., vol. 53, pp. 171–176. Original description of *Scirtothrips longipennis*.

1910 Crawford, David L., Thysanoptera of Mexico and the South, II, Pomona Coll. Journ. Ent., vol. ii, pp. 153–170, figs. 63–70. Original description of *Frankliniella cephalica* and of its worthless "variety" *reticulata*.

1910–1913 Opinions [1–56] Rendered by the International Commission on Zoological Nomenclature, Smithsonian Institution, Washington, D. C., Publications 1938 (July, 1910), 1989 (October, 1910), 2013 (July, 1911), 2060 (February, 1912), and 2169 (May, 1913).

1910 KARNY, HEINRICH, Neue Thysanopteren der Wiener Gegend, Mitteil. d. Naturw. Ver. an. d. Univ. Wien, VIII Jahrg.. pp. 41-57, Taf. v. Original description of the genus *Frankliniella.*

1911 MOULTON, DUDLEY, Synopsis, Catalogue, and Bibliography of North American Thysanoptera, with Descriptions of New Species, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., pp. 1-56. pls. I-VI. Key to North American species of "*Euthrips*" (nec Targioni-Tozzetti); *Scirtothrips longipennis* redescribed as *Euthrips parvus*; original descriptions of *Frankliniella helianthi* and of *Physothrips albus.* The following names are omitted from the list of North American species:

1. Genus *Ctenothrips* Franklin.
2. *Ctenothrips bridwelli* Franklin.
3. *Anaphothrips secticornis* (Trybom).
4. *Anaphothrips longipennis* Crawford.
5. *Thrips lactucæ* Beach.
6. *Thrips trifasciatus* Ashmead.
7. *Phlœothrips caryæ* Fitch.
8. *Phlœothrips mali* Fitch.

1911 TRYBOM, FILIP, Physapoden aus Ägypten und dem Sudan, Results of the Swedish Zool. Exped. to Egypt and the White Nile, 1901, No. 19, pp. 1-16, Taf. I. *Physapus* declared a valid genus name in Thysanoptera.

1912 JONES, PAUL ROBERT, Some New California and Georgia Thysanoptera, Tech. Ser. No 23, Pt. I, Bur. Ent., U. S. Dept. Agr., pp. I-VI, 1-24, pls. I-VII. Key to North American species of "*Euthrips*" (nec Targioni-Tozzetti); *Scirtothrips* sunk as a synonym of *Anaphothrips*; *Physothrips costalis, Ph. longirostrum,* and *Scirtothrips albus* described as new.

1912 KARNY, HEINRICH, Revision der von Serville aufgestellten Thysanopteren-Genera, Zool. Ann., vol. IV, pp. 322-344. The genus *Physothrips* erected; *Euthrips* used for the first time in the sense of *Anaphothrips* Uzel; an excellent synopsis of the known species of the various genera.

1912 BANKS, NATHAN, AND CAUDELL, ANDREW NELSON, The Entomological Code, a Code of Nomenclature for Use in Entomology, Washington, D. C., May, 1912 (published privately). A very comprehensive code of nomenclature, distributed free by the authors.

1912 HOOD, JOSEPH DOUGLAS, Descriptions of New North American Thysanoptera, Proc. Ent. Soc. Wash., vol. XIV, pp. 129-160, pls. IV-VIII. Original description of *Frankliniella stylosa.*

1913 HOOD, JOSEPH DOUGLAS, Nine New Thysanoptera from the United States, Proc. Biol. Soc. Wash., vol. XXVI, pp. 161-166. Original description of *Scirtothrips niveus.*

1913 MORGAN, ALFRED COOKMAN, New Genera and Species of Thysanoptera, with Notes on Distribution and Food Plants, Proc. U. S. Nat. Mus., vol. 46, pp. 1–55, figs. 1–79. *Odontothrips phaleratus* (Haliday) recorded for the first time from North America; original descriptions of *Frankliniella bispinosa* (Morgan), *F. floridense* (Morgan), *F. gossypii* (Morgan), and *F. runneri* (Morgan), all of which were assigned to *Euthrips*.

A NEW MITE FROM THURBERIA.

By NATHAN BANKS, *Bureau of Entomology.*

Eriophyes thurberiæ n.sp.

Body but little more than three times as long as broad, tapering but little behind; the cephalic plate rather narrow in front, with lines, and two rather long dorsal setæ. Abdomen with about fifty rings, plainly punctured; first ventral setæ fully as long as width of body, second pair not noticeable, third pair not as long as width of body, caudal setæ heavier, as long as twice width of body. Legs very short, hardly as long as one-half of width of body, last joint (fifth) nearly as long as preceding joint, but very much more slender, third joint about as long as fourth and fully as thick. Length, 140 μ.

Inhabits much-folded gall on leaves of *Thurberia thespesioides*, near Tucson, Arizona (Pierce coll.).

ACKNOWLEDGMENT.

The Entomological Society of Washington is indebted to Entomological News through Dr. P. P. Calvert for the use of the plate from which the frontispiece of this number is printed.

Actual date of publication March 23, 1914.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVI 1914 No. 2

TWO HUNDRED AND SEVENTY-SECOND MEETING, DECEMBER 4, 1913.

The following officers were elected for the year 1914: President, W. D. Hunter; First Vice-President, A. N, Caudell; Second Vice-President, E. R. Sasscer; Recording Secretary, W. B. Wood; Secretary-Treasurer, S. A. Rohwer; Editor, W. D. Hunter; additional members of Executive Committee, E. A. Schwarz, L. O. Howard, and August Busck. Prof. A. L. Quaintance was nominated to represent the Society at the Washington Academy of Sciences.

Mr. Henry Tryon, Government Entomologist of Queensland, and Dr. T. Harvey Johnston, of the University of Melbourne, addressed the Society. These gentlemen constitute a commission which has been sent abroad by the government of Australia to study the possibility of controlling the cacti of Australia. Among other possibilities that are being considered is the introduction of destructive cactus insects from the United States. The speakers referred to their special interest in the investigation in this country on account of the studies of cactus insects which have been conducted. The importance of the cactus problem in Australia was graphically described, and hope was expressed that the investigation would reveal biological factors that might assist in control.

Doctor Martini, of the Hamburg School of Tropical Medicine, also addressed the Society with reference to his studies in the United States, and his recent trip to the Canal Zone.

Mr. A. H. Jennings gave an account of his recent extensive trip in the British West Indies in company with Doctor Sambon, of the London School of Tropical Medicine, for the purpose of determining whether endemic centers of pellagra are found where certain biting flies are absent.

Two Hundred and Seventy-Third Meeting, January 4, 1914.

The following were elected to membership in the Society: B. R. Coad, A. W. Jobbins-Pomeroy, Father De Gryse, R. H. Hutchison, E. A. McGregor, Wm. Schaus, J. K. Strauss, and G. N. Wolcott.

The retiring President delivered the following address:

ANNUAL ADDRESS OF THE PRESIDENT.

ON THE CLASSIFICATION OF THE MICROLEPIDOPTERA.

By August Busck.

The term Microlepidoptera was originally used by German Lepidopterists about the middle of the last century as a literal translation of the much older, popular name, "Kleinschmetterlinge." It was used as a collective name for the five then recognized families of small moths: the Pyralids, the Tineids, the Tortricids, the Pterophorids and the Ornerodids. At that time it was already recognized by leading workers, such as Zeller, Herrich-Schäffer and Stainton, that their division of the Lepidoptera into Macros and Micros was not a natural one, but this division has been retained in about the original sense even up to the present day in Germany.

Most modern students have discarded the name Microlepidoptera as untenable; first, because it is said to be a misnomer; second, because it could not be sharply defined as a natural group, if the original conception should be retained.

It is true that mere size does not make the distinction. Some large moths are included in the term, while many small Lepidoptera fall outside the conception. However, these exceptions form a small percentage of the whole and the bulk of the Microlepidoptera are truly micros in a literal sense.

The second objection, that the term is not definable as a natural group, is true if the original conception is strictly adhered to.

The large Pyralid group has a quite separate origin from, and cannot properly be associated with, the rest of the Microlepidoptera, in the last century's sense. It has also been found that the Ægeridæ and the Cossidæ, which were originally classed as Macros, have their affinities with the Micros. But with these and a few other minor subtractions and additions the group becomes an undisputed natural one, and it seems unwise altogether to abandon such a long established, commonly used, descriptive name, which conveys a generally understood, even if not sharply defined conception. The term may conveniently be retained, if restricted to denote collectively the natural group of superfamilies considered in the present paper. This conception does not coincide with the term as used by Stainton and the other old authors, nor does it coincide with Hampson's and Dyar's superfamily Tineoidæ, differing from both mainly in the exclusion of the Pyralidæ, together with the smaller families of Pyralid origin.

The systematic arrangement of the Microlepidoptera has progressed along much the same lines as that of the other groups of insects from the time of Linnæus to the present day. It has developed from a system founded on external, easily observed characters, such as color and outline, to one founded on structure.

From Linnæus up through the illustrious series of old world scientists who worked with this group of insects, Fabricius, Schiffermüller, Ochsenheimer, Treitschke, Hübner, Haworth, Curtis, Stephens, Latreille, Duponchel, Guenée, and others, color and pattern, together with the form of wings, antennæ and palpi, were the main characters used for generic differentiation.

Herrich-Schäffer was the first to realize the systematic value of wing venation and his monumental work, Die Schmetterlinge von Europa, must be regarded as the cornerstone for the modern classification of Lepidoptera. So far in advance of its period was this work that very few contemporaneous and subsequent students realized it as anything but a laborious curiosity. There was a certain wondering admiration for it, but no actual belief in its practical value and no desire to go to the trouble of using it. Even such an enthusiastic student as Stainton took no pains to go into the subject, though he probably realized its eventual value. He had his artist make most careful plates of wing venation for his Insecta Britannica, but neither here nor in his later works, did he ever use the venation in his generic tables of definition.

Neither did Zeller and Walker take much advantage of Herrich-Schäffer's good work, but continued to make genera on "obvious" characters; among which they and others naturally included secondary male sexual characters, a procedure which has unfortunately been followed up to a quite recent time.

Heinemann, Lederer and Wocke followed Herrich-Schäffer's lead, but without advancing beyond his recognition of the venation as an aid to classification, and they and other workers of the period continued to be influenced by Zeller, who was the object of a cult entirely out of proportion to his merits as a systematist.

Our American pioneers in the Microlepidoptera, Brackenridge-Clemens, and in a less degree, Chambers, had a keen appreciation of the value of wing venation as a generic character and drew, for example, far more advantage from Stainton's plates than did Stainton himself.

Walsingham began his career as a Microlepidopterist as a disciple of Stainton and Zeller and his earlier work shows the effect. In his later working years, he realized the fallacies of this system and consigned many of his earlier genera to the synonomy, continuing his work together with Durrant, on sounder lines.

To Herrich-Schäffer and his followers the characters of the venation were merely a means of classification. They found that groups of species, which had been associated in genera on other characters, agreed in venation and that this character was more dependable than most of those which had hitherto been used. There was, as yet, no science of phylogeny and no continuity in the arrangement of the genera.

It was not until Darwin's theory of evolution had been advanced, that the time was ripe for the realization of the full importance of wing venation as indicative of phylogenetic relationship and many years passed without the application of this principle.

It remained for Edward Meyrick first to apply Darwin's theories to the study of Microlepidoptera, and, with the aid of modern morphological studies, to grasp the possibilities of the wing venation as a means of recognizing natural relationship and lines of development. His ingenious rearrangement of the Microlepidoptera along natural evolutionary lines revolutionized the study of this group and has resulted in a sound appreciation of their mutual relationship and an undoubtedly nearly natural grouping of these insects.

Similar masterful studies of the lepidopterous wing venation with similar good results were made independently in Germany by Arnold Spuler and in America by Comstock. To them is due, among other things, the important discovery of the fundamental significance of the clavus, or as it is better known in this country by Comstock's somewhat later name, the jugum, a small projection from the base of the fore-wing which serves to hold the two wings together in the primitive groups of Lepidoptera, the Micropterygidæ and the Hepialidæ.

The classification of these masters has been adopted and further developed by all modern students, and the one paramount character used in this classification is the wing venation. This does not mean that it is the only character used. Every structural difference, especially of the palpi, antennæ and legs, is considered, as are the early stages and the biology, but all of these are given less weight than the venation and are now never used except in connection with the venation.

That this is a sound scientific view is easily understood when it is considered that all of the external characters more or less directly serve some purpose useful to the insect and therefore tend to become modified in response to the requirements of changed conditions in the environment.

On the other hand, the venation is not influenced in such a direct way and undergoes changes but slowly through long periods of evolution. It might be supposed that the mechanical function of the veins as a support to the wing surface would invite modification of the veins, and such is truly the case to some extent, the tendency in the evolution being a strengthening of the costal area at the expense of the dorsal. But the mechanical support would not be especially benefited by such minute changes in the structure as we find; the entire outline of the wing may be greatly changed without any radical change in the venation.

At the same time, the venation is so plastic as to mirror in minute modifications any and every step in the evolution of the genera. Given merely the denuded wings of a Microlepidopteron it is possible with certainty to place the species generically.

It has long been realized that the origin of all Lepidoptera is to be found in the Micropterygidæ. These possess several additional veins, which cannot be explained in any other way than as primitive characters, according to the fundamental law that no new organ can be developed except as a modification of an existing character. The survival of a few species of this ancestral group is exceedingly fortunate. Without these we should be without the key to the relationship of the entire order, because the higher Lepidoptera are so different from any other group of insects that their relationship hardly could have been established without the connecting link of the Micropterygidæ.

The Micropterygidæ are in turn generally conceded to have developed from the caddis-flies; certain of the Trichoptera (the genus *Rhyacophila*) agree very closely in neuration as well as in other characters with the more generalized Micropterygidæ, while no other insect of any order approaches this type. This is correctly taken as conclusive evidence that the Micropterygidæ are derived from, or are at least correlated with the Trichoptera,

which order, on the whole, is the more primitive group with a much more complicated venation in its more generalized genera.

The possession of additional veins in the hind-wings is the most important character which distinguishes the Micropterygidæ and the Hepialidæ, the other primitive group of Lepidoptera, from all the rest of the Lepidoptera. Another distinguishing character of these two families, the mode of interlocking the wings was independently pointed out by Spuler and Comstock. The lobe at the base of the fore-wing, which serves to hold the hind-wing in place, the clavus or jugum, is undoubtedly a good primitive character. It is found in both fore- and hind-wings in all the Trichoptera; it also persists though less developed in the hind-wing of the Micropterygidæ and is analogous with the posterior lobe in the hind-wings of the Diptera.

Besides the jugum, there are already, in the Micropterygidæ, a series of small stiff spines on the costal edge of the hind-wing which assist in holding the wings together. These spines develop gradually in the higher Lepidoptera into the so-called frenulum, which in the primitive group, Aculeatæ, persist as a series of spines but in the higher groups is reduced to a single strong spine in the male, and to two, three or four similar, weaker spines in the females. This is one of the curious examples of how the males lead in the evolution. Another, even more remarkable example of this is found in certain isolated genera where the males are ahead of the females in the venation, having two veins entirely coincident, which in the more conservative females are only stalked.

The Ægeridæ is the only family in which the females have also advanced to the single frenulum. Everywhere else this is distinctly a male character and is a dependable one on which to distinguish the two sexes.

In some of the highest groups of Lepidoptera, the Saturnids and the Butterflies, where the strongly developed dorsal part of the fore-wings broadly overlaps the equally developed costal part of the hind-wings and thus insures the interlocking of the wings, the frenulum has become obsolete.

When a partially denuded wing of a Micropterygid is examined under strong magnification it is found that its surface is covered with minute curved spines between the scales and much more numerous than these. Spuler was the first to point out this character, which is found in all Trichoptera, as well as in some other groups such as the Blattidæ and the Perlidæ.

These spines, "aculei," are not loosely inserted in pockets in the surface of the wing as are the scales, but are minute, hollow protuberances of the wing itself, and do not rub off when the wing is denuded. This primitive character is lost in all the higher

Lepidoptera, except in a small group of families, which until recently has been associated with, and derived from the Tineidæ, but which, on this character alone must be placed, as Spuler has done, quite apart from the other non-aculeate Microlepidoptera.

The development of the venation is towards the reduction of the number of veins, mainly by coalescence, though frequently by becoming obsolete, and this is the guiding principle in the classification. Thus a genus with all the veins present cannot be deduced from one with a less number of veins, according to the fundamental law that a lost character cannot be regained. Similarly, a genus with two veins separate cannot normally be derived from one in which these two veins are stalked, that is, partly coalescent.

The reduction of veins has gone on in all branches of the system of families, but reaches its climax in the genus *Opostega*, where all but a few principal longitudinal veins have become obsolete. In it we have a striking case of an apparently "simplest" form, which in reality is the most highly developed in the group.

A very different result from the same tendency to vein reduction is found in the Cosmopterygidæ, where the number of veins in some genera has been preserved, but where several of the veins have coalesced at base on account of the wings becoming very narrow and pointed, producing a many branched venation.

On these principles the present system has been built up, not that the venation alone has been used (in fact, most of the genera were made on other characters entirely, long before the value of venation was realized) but the vein characters are now used as the final test. If two species vary in any essential of the venation, they are separated generically on that character alone, even should they agree in all other characters.

However, the venation, as well as any other character, must be used with good sense, and only one thoroughly familiar with the group as a whole, is safe in applying the test in the numerous difficulties which occur.

Thus a character may be an essential one in a higher developed group of genera and of relative unimportance in a more generalized group which has not yet acquired the same constancy. In the Gelechiidæ, Xyloryctidæ, Œcophoridæ and Cosmopterygidæ, for example, veins 7 and 8 of the fore-wings are invariably stalked, or coincident without exceptions, but in lower groups, like the Plutellidæ or Acrolophidæ, these same veins may be stalked or separate within the same genus or even within the same species, and consequently cannot be given the same value here as in the higher groups. But it should be noted that even with this variability, the venation furnishes sufficient stable characters in the

lower families also. A species of *Monopis*, for example, can always be determined generically with certainty from the venation alone, though hardly two specimens can be found in which the vein course is identical.

Much more difficult problems arise because the potentiality of vein differentiation after all is a limited one, and that therefore genera of different groups, converging toward the same general scheme of a wing support, may independently attain results which are embarrassingly similar.

This fact has in many cases long delayed the true appreciation of some groups and only patient study and comparison with allied forms have made it possible to place them where they rightly belong. An example will illustrate these difficulties. The Gracilaridæ, to which the leafmining genus, *Phyllonorycter* (*Lithocolletis*), belongs, are distinguished from all other Micros by the fact that the mature larvæ have prolegs on only three of the middle abdominal segments instead of on four or more, and by the fact that the first larval stages exhibit a very peculiar, highly specialized modification of the mouth parts, not approached by any other lepidopterous larva. Until recently the group has been regarded as a part of the Tineidæ or Plutellidæ, because the pterogostic and oral characters apparently did not preclude a derivation from some generalized form within these families. However, it was felt that they were in some way out of place and about a year ago, our fellow member, Dr. Charles Ely, who was making a thorough study of the American species of *Gracilaria*, called my attention to an undeniable evidence of their separate family rank, which has been before all students of the group in Stainton's careful plates of wing venation published fifty years ago, but which no one had properly interpreted before. Stainton's figures of the wings of *Gracilaria* and *Ornix* both have the full number of veins in the hind-wings, eight, apparently only slightly differently placed. But if we study them carefully, we will see that it is not the same veins that have persisted. *Ornix* has one costal vein more than *Gracilaria* and *Gracilaria* has one dorsal vein more than *Ornix*.

The large number of common characters both in the larvæ and the adults prove conclusively that these two genera are truly closely related. The only explanation, then, is that both must have been derived from a common ancestor having nine or more veins. By denuding various species of *Gracilaria* we found some in which all of the nine and even ten veins had persisted. Such a group with this number of veins clearly can not be derived from either the Tineidæ or the Plutellidæ, which have only eight veins, but must have developed independently, from a point lower down, nearer the Micropterygidæ.

A parallel case is that of the Cygnodiidæ. Until a few years ago the species of this group were classed in the same family as the Cosmopterygidæ, which they resemble superficially very much. In a paper before this Society in 1909, I pointed out, as Herrich-Schäffer had already figured without realizing its importance, that some of the genera of this group have nine veins in the hind-wing and therefore cannot be derived from a stock where the vein reduction has already taken place.

Incidentally these two examples illustrate the value of conscientious figures, which depict all the student sees, not merely what he wants to see. In the venation plates of these two old authors, Herrich-Schäffer and Stainton, we have had before us for more than half a century, the faithfully presented evidence of important phylogenetic significance, which only now has been realized and in both cases it was this evidence that gave the initiative to further study and better understanding.

A very satisfactory appreciation of the genera has been reached by the study of the wing venation. There is no doubt that most of the genera recognized at present are natural entities. The component species of any genus agree in practically all characters except in color and in secondary sexual male characters and even these latter, as well as the color scheme and pattern are often peculiar to a genus, differing among its species only in details.

Their biology and larval characters also prove that the present day genera are natural entities. In very many cases it is possible to definitely determine the genus of a Microlepidopteron merely from the work, or the mode of pupation or some other biological peculiarity. The mines of *Phyllonorycter* (*Lithocolletis*), *Tischeria*, *Phyllocnistis*, and *Nepticula*, or the cocoons of *Bucculatrix*, *Marmara*, or *Gracilaria* are familiar examples of this fact.

Likewise, we now have a reasonably satisfactory understanding of the grouping of the genera. There is no doubt that practically all families at present recognized are actual natural groups of closely correlated genera, agreeing in essential pterogostic and oral characters, as well as in general habitus, often exhibiting even a common pattern scheme and a similar biology.

It is when it comes to a phylogenetic valuation of these so-called families, that there is considerable room for improvement. In other words, the groups of genera, which, by nearly unanimous consent are called families, are phylogenetically of very different systematic value. For example, the characters which separate Cosmopterygidæ and the Gelechiidæ from the Xyloryctidæ or from the Œcophoridæ and Blastobasidæ are not nearly as fundamental as those which distinguish the Coleophoridæ or the Acrolophidæ, even though they may be fully as easy to observe, and the

so-called families Graciilaridæ, Cygnodiidæ or Acrolophidæ are each phylogenetically equivalent to the entire group of families derived from the so-called families Plutellidæ and Tineidæ.

From the aculeate Micropterygid stock two main groups arise, one which has retained the aculeation and one in which this character is lost. The aculeate group contains such families as the Prodoxidæ, the Adelidæ, and the Incurvariidæ and culminate in the leafmining Nepticulidæ;[1] *Opostega* also must be referred to this group.

The generalized nonaculeates give rise to a number of independent main branches, each in reality of more than family rank, such as the Acrolophidæ, Cossidæ, Tineidæ, Hyponomeutidæ, Gracilariidæ, Coleophoridæ, and Cygnodiidæ, from which in turn the higher families, such as the Gelechiidæ and Cosmopterygidæ, the Plutellidæ and Hemerophilidæ and the Heliodinidæ are minor branches (pl. II).

It may be questioned whether it would be advisable to introduce a number of intermediate valuations in the form of subfamilies and superfamilies and suborders (and even these forms will hardly express the complex system adequately) and whether such a scheme would be rather a cumbersome, impractical burden for the student. My own inclination is to express the system in as true terms as possible.

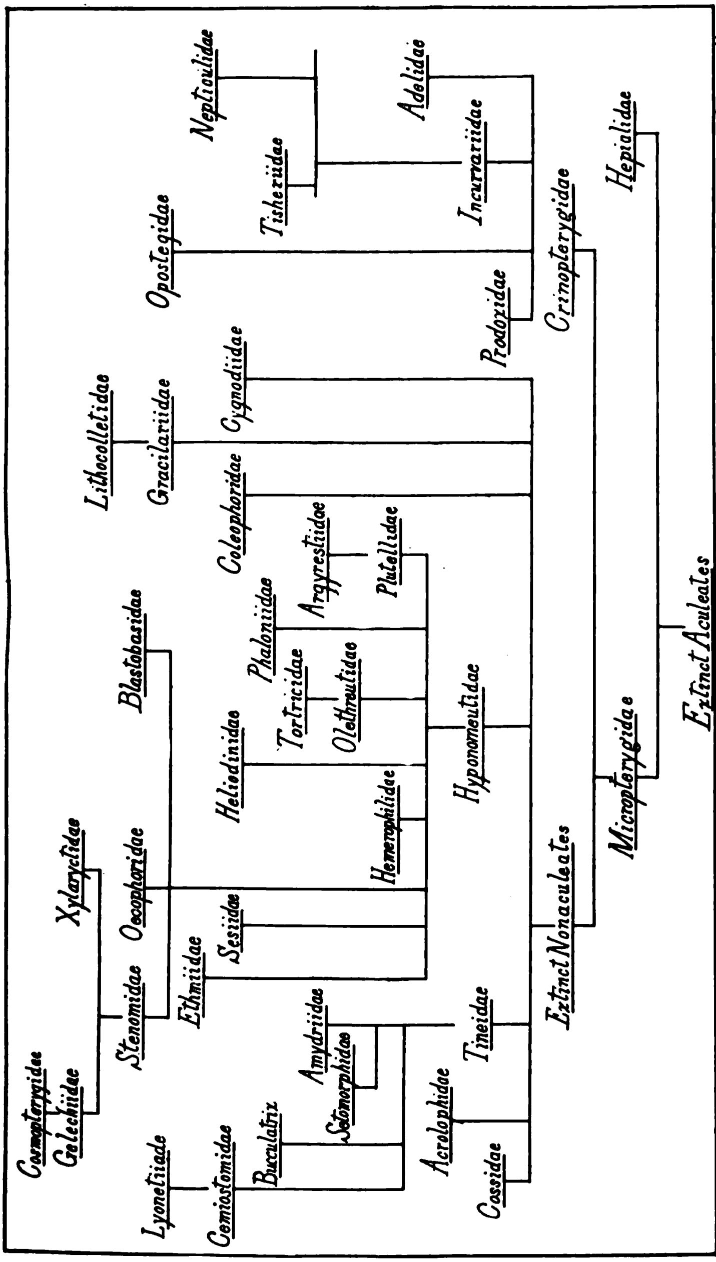
But the terminology is the least part, the main thing is, that the student should keep in mind the fact that the families of Microlepidoptera, as they are at present used by the leading specialists of the group, are not truly equivalent entities. Only thereby is a sound perspective of the group possible, and only thereby can further addition to the systematic structure be made along natural lines.

Two Hundred and Seventy-Fourth Meeting, February 5, 1914.

A special committee consisting of Messrs. Heidemann, Schwarz, and Banks, presented a biographical sketch of O. M. Reuter which was accepted for publication.

The following papers were presented:

[1] The highest specialization, connected with the leafmining habit, is found at the apex of several of these branches and has therefore been quite independently reached by such genera as *Nepticula*, *Phyllonorycter* (*Lithocolletis*), and *Tischeria*.



Phylogeny of Principal Families of the Microlepidoptera.

[redacted]

ON THE ABDOMINAL STRUCTURE OF CERTAIN BEETLE LARVÆ OF THE CAMPODEIFORM TYPE. A STUDY OF THE RELATION BETWEEN THE STRUCTURE OF THE INTEGUMENT AND THE MUSCLES.[1]

By A. G. Böving, Ph.D., *Bureau of Entomology.*

Doctor Hopkins' classical monograph of the genus *Dendroctonus*, 1909,[2] was the first successful attempt to formulate a complete and practical terminology for the external structure of a Coleopterous larva, and may well serve, as Doctor Hopkins expressed it in his introduction, "as a guide to the determination of further facts relating to insect anatomy in general." The need of such a uniform terminology for the Coleopterous larva as elaborated by Doctor Hopkins in this monograph, had long been felt, because a truly comparative description is not possible without a defined terminology comprising *all* the body parts. The descriptions of even Schiödte, the unsurpassed master of larval classification, are lacking in this respect. The work of Doctor Hopkins was readily appreciated by students of the subject. Thus Henriksen[3] Kemner[4] Rosenberg,[5] and the writer[6] have at once adopted his terminology in so far as it was found applicable to the so-called compodeiform larval type with which these authors worked. The external skeleton of the abdominal parts of this campodei-

[1] Contribution from Division of Forest Insect Investigations. Bur. of Ent., U. S. Dept. of Agric.

[2] Hopkins, A. D., The genus Dendroctonus. (U. S. Dept. Agric., Bur. of Ent., Tech. Ser. no. 17. Part I, Washington, D. C., 1909, pp. 57–64.)

[3] Henriksen, Kaj L., Danske Elateridelarver, Entomologiske Meddelelser, II ser., vol. IV, 1911, pp. 225–331. Idem, Pragtbiller og Smeldere "Danmarks Fauna," published by Dansk Naturhistorisk Forening, 1913.

[4] Kemner, A. Beitrage zur Kenntnis einiger Schwedischen Koleopterenlarven, Arkiv für Zoologie, Bd. 7, no. 31, 1912, p. 1–31.

[5] Rosenberg, E. C., Bidrag til Kundskaben om Billernes Levevis, Udvikling og Systematik. III, Billefauna i Dyreboer, Entomologiske Meddelelser, vol. 10, 1913, pp. 37–76.

[6] Böving, Adam, Nye Bidrag til Carabernes Udviklinghistorie I Entomologiske Meddelelser, II ser, vol. III, 1910, pp. 219–376. Idem, Nye Bidrag til Carabernes Udviklingshistorie, II. Entomologiske Meddelelser II, ser. vol. IV, 1911, pp. 129–180.

form type differs, however, from that of the Scolytidæ with which Doctor Hopkins dealt, and his terminology elaborated for the Scolytidæ is therefore not immediately applicable to the campodeiform larvæ. In the hope of finding a foundation for a natural and logical terminology for the body of this type, I began, some years ago, a detailed study both of the external and internal surfaces of the skin as well as of the arrangement of the muscles in these larvæ. I have been fortunate in being able to continue these studies under most favorable conditions since my arrival in this country. In Denmark, I studied more particularly the Carabid, Dytiscid and Hydrophilid larvæ, while here the Trogositid, Clerid and Elaterid larvæ were chosen, because they play a more important rôle in the Branch of Forest Insects, with which I became connected.

Some of the results of these studies are presented in this paper, and I believe they will be found useful in the study of other campodeiform larvæ. The eventual application of these results also to the deviating eruciform type to which the Scolytidæ belong, I purposely postpone. I believe that the characters of these two groups eventually may be homologized, but this will involve considerable further anatomical study and the question is not taken up in this paper. From the insufficient investigations I have made of Lepidopterous, Hymenopterous and Neuropterous larvæ, I am inclined to believe that the characters described in the present paper will be found useful in the larval study of all the insects with complete metamorphosis.

While the terminology has been derived from an anatomical study of the inside of the integuments and of the muscles, the structures can also be made out externally, but they can only be understood by a study of the inside, and it would have been impossible to homologize the external characters without a comparative study of the muscles. It should be stated however that the terms used in this paper for the various structural parts are purely provisional. The limitation and definition of the areas has been the main object; the names have been a minor consideration.

THE INTERSEGMENTAL SKIN

The segments of an insect larva are, as is well known, connected by a perpendicular intersegmental skin, but a more intimate study of this skin has never been made. This intersegmental skin is divided on each side into two more or less wedge-shaped parts: the superior cunea (*s*) with the point downwards, and the inferior cunea (*i*) with the point upwards. The ends of these two cuneæ pass each other more or less, that of the superior cunea always

in front of the inferior. At the end of each cunea there is a thickening of the membrane which on the inside forms a small notch to which muscles are attached. I call these thickenings relatively, the anterior (*an*) and the posterior (*pn*) cuneal notch. Another similar notch is found in the upper portion of the anterior cunea; I call this the superior cuneal notch (*sn*). Finally there is a fourth notch on the median ventral line of the posterior cunea; this I term the ventral cuneal notch (*vn*).

THE LATERAL ZONE

Between the posterior cuneal notch of one intersegmental skin and the anterior cuneal notch of the succeeding intersegmental skin is found, on the inside of the integument, a staff-like or even carinated apodeme, which on the outside appears as a deep groove. This groove has been named by Doctor Hopkins the pleural suture (*pl*). Above and parallel with the pleural suture is found a similar one which I call the antipleural suture (*anti*). This is sometimes more, sometimes less developed than the pleural suture. It is somewhat shorter than the pleural suture and does not reach either of the margins of the segment. The bandlike region between these two sutures I call the lateral zone. This lateral zone has, as already pointed out by Dr. David Sharp in his handbook, 1901, p. 90, a mechanical use in the dorso-ventral compression of the larval body corresponding to that of the intersegmental skin in the telescoping compression, and it is stiffened on the inside by a circular thickening which touches both the antipleural and the pleural suture. This circular thickening limits an area, which on the outside is elevated and rounded; it is the area which has been termed the pleural lobe (*pll*) by Doctor Hopkins. The rest of the lateral zone is divided by oblique sutures into four small triangular parts, two before, and two behind the pleural lobe. I call these respectively the protopleurite (*prpl*), the deuteropleurite (*dpl*), the tritopleurite (*tripl*) and the tetrapleurite (*tetpl*). All of these four small areas are prolonged more or less upward along the superior cunea.

The whole lateral zone can be compressed by two systems of perpendicular muscles. The muscles of the first system run upwards from the middle of the pleural suture; while the muscles of the other system run downward from each end of the antipleural suture. When the muscles are relaxed, the pleural and antipleural sutures are again separated by the elasticity of the pleural lobe and of the oblique sutures.

THE DETERMINATION OF THE LINES AND AREAS ABOVE AND BELOW THE LATERAL ZONE

Above the antipleural suture the segment is divided into the following areas:

Prescutum (*prsc*), scutum (*sc*), scutellum (*scl*), parascutum (*pasc*), postscutellum (*pscl*), and the spiracular area (*spa*).

The scutum and scutellum, which are sometimes hardly separable, form the central dorsal part; in front of these is the prescutum, below and partly around them the parascutum, and behind them, the postscutellum. Underneath those areas and limited on the other side by the antipleural suture lies the spiracular area.

All areas are defined by lines, fine wrinkles in the integument, radiating from and determined by muscle attachments. In order to make the figures as comprehensible as possible and in order to avoid too many letters I have signified the muscle spot, its radiating lines, and the area determined thereby, by the same letter, and each muscle is then determined by the letters of the two muscle spots between which it runs. The boundary line of scutum and scutellum, I call the scutal line (*sc*). This is determined by a muscle spot from which a long muscle (*sc-pn*) runs down to the posterior cuneal notch. The transversal line separating scutum and scutellum I call the scuto-scutellar line. The prescutum is bounded by a line, the prescutal line (*prsc*), which runs from the superior cuneal notch to the anterior margin of scutum. The boundary line of parascutum, I call the parascutal line (*pasc*). This is determined by a bundle of three muscles (*pasc-pl*), which run down to the pleural suture (*pl*). The parascutum is divided by a more or less curved line connecting the scutal and the parascutal line. I call this line the parascutal divisor (*d*). It is determined by a flat muscle band (*d-s*), which runs backwards to the superior cunea (*s*). This line is in reality a row of little dots and varies considerably in size and position in the different types of larvae; often it is also continued downward, below the parascutal line. The postscutellum (*pscl*) is limited by the postscutellar line, which runs behind the parascutum through the superior attachment of the muscle (*pscl-hypl*), and terminates at the posterior end of the antipleural suture. The spiracular area (*spa*), is characterized by the presence of the spiracle and is limited above by the parascutal line, below by the antipleural suture.

AREAS BELOW THE LATERAL ZONE

Below the pleural suture the segment is separated into the following areas: the hypopleurite (*hypl*) immediately below the pleural suture, the presternum (*prst*) and sternum (*st*), generally

more or less united, separated by the triangular parasternum (*past*), from the sternellum (*stl*), behind which is the poststernellum (*pstl*).

The line limiting the hypopleurite below, I call the hypopleural line (*hypl*) and it is determined by perpendicular muscles running from the posterior end of the antipleural suture (*anti-hypl*). This hypopleural line consists of two pieces. Below the anterior piece lies the parasternum, below the posterior, the poststernellum. The line separating the parasternum from the sternum I call the sternal line (*st*). This is determined by three long oblique muscles, two from the superior cunea, just in front of the spiracle of the following joint (*s-st*) and one (*an-st*) from the anterior cuneal notch. The two first mentioned muscles are closely united at their lower end in the *Trogosita* and *Alaus* larvæ, while in *Clerus* they are plainly separated (fig. 1, pl. III). The line limiting poststernellum anteriorly against sternellum I call the poststernellar line (*pstl*), and this is determined by a short oblique muscle from the anterior cuneal notch (*an-pstl*). The other, anterior, side of sternellum is defined by a line, the sternellar line (*stl*), from the end of the anterior piece of the hypopleural line to the posterior end of the sternal line.

The study of the muscles, is as stated in the beginning, essential to the correct understanding of these integumental parts. Without such a study it is well nigh impossible to interpret the structure of the surface in the more complicated cases. A few examples will suffice to demonstrate this. In *Alaus* (fig. 8, pl. VI), the muscles show that the first line below the pleural suture is but a branch from the hypopleural line which is normally simple, and that the hypopleurite, consequently, in this larval type consists of two distinct pads, while in the other types this area is undivided. Similarly, it could not have been recognized without muscle study that the broken sternal line in *Trogosita* (fig. 5, pl. V), is identical with the straight sternal line in *Clerus* (fig. 1, pl. IV), and *Alaus*, a modification which makes the shape of the parasternum quite different in these forms.

In the above I have only mentioned the muscles, which have a direct bearing on the formation of the various areas. There are, however, a great many others, and a short account of these may be useful in the identification and location of the leading muscles, used in this paper. They are:

(*s-s*). Longitudinal, bandlike dorsal, muscles in parallel series immediately underneath the integument as far down as to the spiracle; they run between a superior cunea in front and the following superior cunea posteriorly (fig. 3).

(*i-i*). Longitudinal, bandlike, ventral muscles in parallel series

immediately underneath the integument, below the pleural suture; they run between an inferior cunea in front and the following inferior cunea (fig. 3).

(*st-i*). Small oblique muscles between sternum and the inferior cunea (fig. 2).

(*s-fw*[7]*-sc*). Longitudinal muscles from the superior cunea above the superior cuneal notch, across the scutellum to the scutum.

(*s-fw-scl*). Oblique muscles from the superior cunea to the scutellum (fig. 3).

(*an-tetpl*). An oblique, single, small muscle from the anterior cuneal notch to the superior part of the tetrapleurite (fig. 4).

(*an-sn*). A vertical pair of muscles from the anterior cuneal notch to the superior cuneal notch (fig. 4).

(*an-pn*). A single, horizontal muscle between a posterior cuneal notch and the anterior cuneal notch of the following intersegmental skin (fig. 3).

(*vn-dpl*). One or two large, oblique muscles from the ventral cuneal notch to the anterior curve of the pleural suture below the deuteropleurite (fig. 4).

(*dpl-fw-s*). An oblique, short, but rather broad band from the anterior curve of the pleural suture below the deuteropleurite to the superior cunea near the spiracle (fig. 4).

(*dpl-prst*). A vertical muscle from the anterior curve of the pleural suture below the deuteropleurite to the presternum. (This I have found only in *Trogosita*, fig. 6.)

(*spa-pn*). A pair of perpendicular muscles between the posterior cuneal notch and the spiracular area just below the spiracle.

(*pl-hypl*). One or some few small vertical muscles from the middle of the pleural suture to the hypopleural line (fig. 4, fig. 6, 2. Not found in *Alaus*.)

(*tetpl-hypl*). A vertical muscle from the tetrapleurite to the hypopleural line (fig. 4).

(*pscl-hypl*). A long, perpendicular muscle from postscutellum to the hypopleural line, the definition of the postscutellar line (fig. 2). See p. 58.

In the preceding I have endeavored to demonstrate that the abdomen of the larvæ under consideration is made up, in an identical manner, of the intersegmental skin, the lateral zone, and the regions above and below the lateral zone, and further that the arrangement of the muscles between these parts is uniform. This remarkable uniformity of structure has been preserved throughout the genetic evolution because it enables and conditions the elementary movements of the abdomen. These elementary movements are but two. First, the telescoping of the segments,

[7] *fw* indicates "forwards to;" *bw* indicates "backwards to."

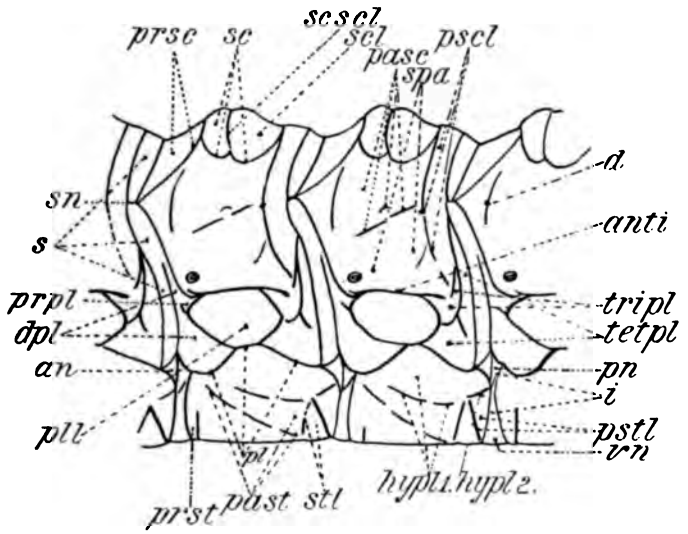


Fig 1. *Clerus* (x 20)
The areas of abdomen

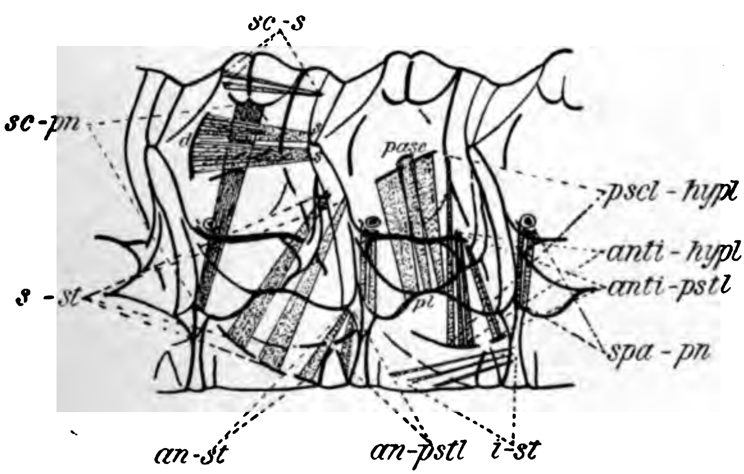


Fig 2. *Clerus* (x 20)
Muscles causing boundary lines of the different areas

PROC. ENT. SOC. WASH., VOL. XVI.

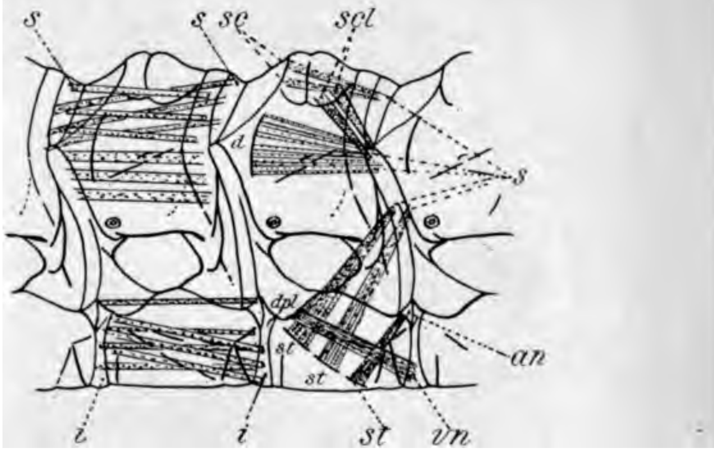


Fig 3. *Clerus* (x 20)
Muscles effecting the telescopic movement

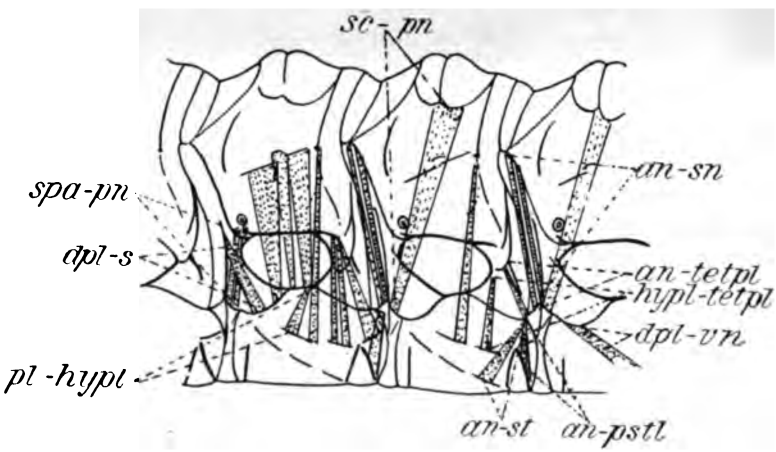


Fig 4. *Clerus* (x 20)
Muscles effecting the dorso-ventral movement

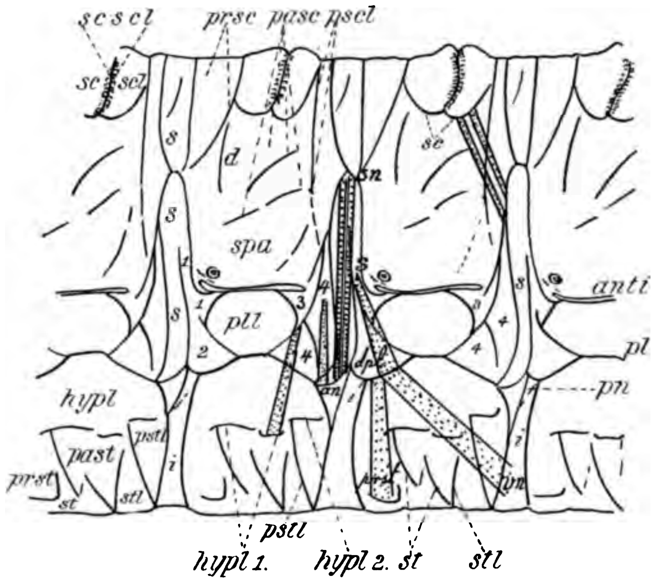


Fig 5. *Trogosita* (x 20)

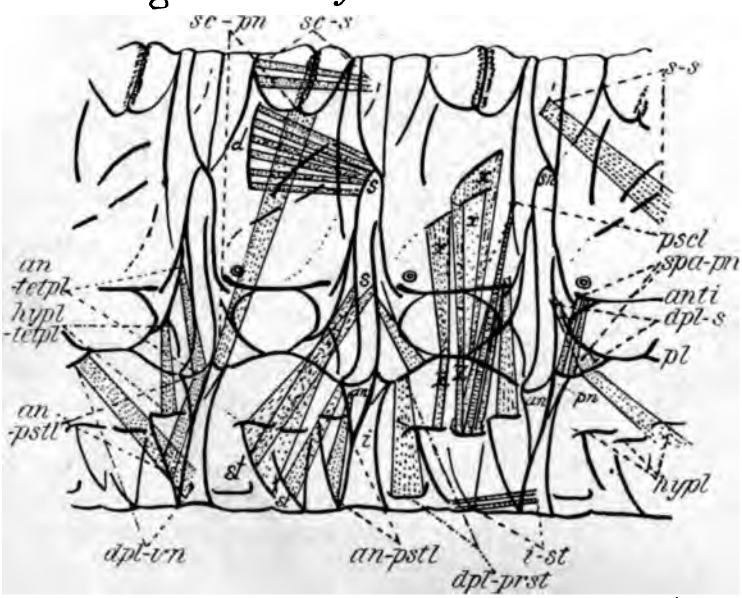


Fig 6. *Trogosita* (x 20)

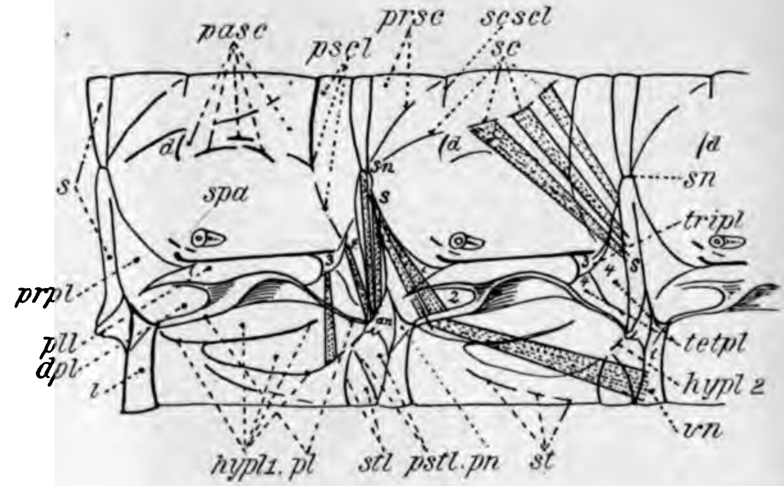


Fig 7. *Alaus* (×8)

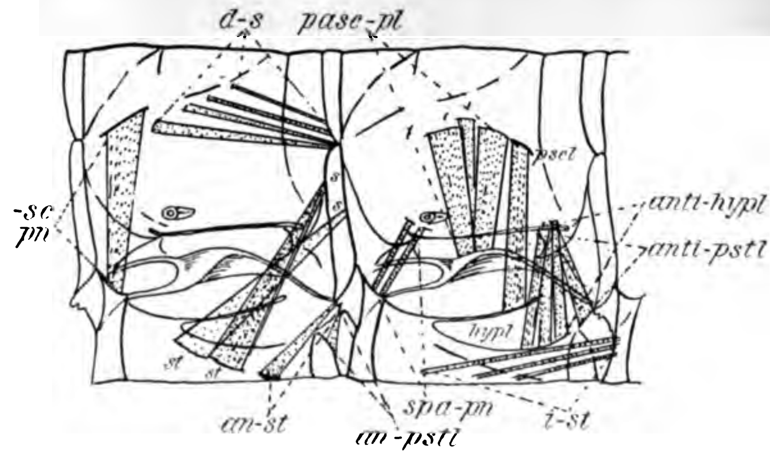


Fig 8 *Alaus* (×8)

by which the intersegmental skin is bent inwards and the front margin of each segment is pushed into the posterior margin of the preceding segment. Second, the dorso-ventral flattening of the abdomen by which the lateral zone is compressed and the edges of the two cuneæ are made to pass further by each other.

The telescoping movement is mainly produced by contraction of the longitudinal muscle bands and the dorso-ventral movement is performed by contraction of the perpendicular muscles. The oblique muscles assist in both of these movements. It is a matter of course that in these elementary movements of the abdomen the muscles on both sides of the body act in unison. A one-sided action of the longitudinal muscles controlling the telescoping of the segments naturally produces a movement of the abdomen to that side, movements which, however, are more or less assisted by the system of transverse and especially of the oblique muscles. In a great many beetle larvæ, more especially in those which live in galleries in wood or bark, such as Cerambycids or *Trogosita*, or those which crawl among moist, dead leaves, such as the Hydrophilids: *Enochrus* and *Hydrobius*, are developed the so-called ambulatory ampullæ, which assist in the locomotion.

There seem to be no special muscles for the retraction of these ampullæ; they are controlled by a mechanical combination of muscles, present in all campodeiform larvæ.

It should be noted here, that the muscles only cause the contraction of these ampullæ as well as the compression and telescoping of the segments. The opposite action in these larvæ by which the parts are extended is not produced by the muscle system at all, but by blood pressure, aided by the elasticity of the integument, which in some parts is especially developed for this purpose, as in the sutures and circular thickening of the lateral zone.

In discussing the foregoing paper Dr. A. D. Hopkins said: "I am naturally gratified that the results of Doctor Böving's study of the muscles of the abdominal segment in certain 'campodeiform' types of coleopterous larvæ has tended to verify my conclusions and suggestions relating to the external elements of the 'eruciform' type as represented by the scolytid larvæ.

"I want to congratulate him on this splendid piece of work and the further contribution of facts bearing on this important subject. It is of the greatest importance that we should be able to identify the immature stages of forest insects because it is the

wood and bark boring larvæ that are most frequently met with by investigators and sent in by correspondents.

"I think that we will find the principal distinguishing characters in the head and mouth parts but these must be correlated with thoracic and abdominal characters. Therefore we need a more exact knowledge of the primary external elements of structure and a key to such of the so-called homologous elements as are of the greatest taxonomic value.

"In my work on the anatomy of *Dendroctonus*, I found that the pleural suture was of fundamental importance as a guide to the location and identification of elements of structure in the adult, pupa and larva (Technical Series 17, part 5, Bureau of Entomology, 1909, fig. 9, 38, 39). In the work carried on by Mr. Snodgrass and myself on the thorax of insects we found that the key to the structure of the pleurum in adult insects was the pleural suture (Proc. U. S. N. M., vol. XXXVI, 1909, p. 536, fig. 3). Now with the additional facts revealed by Doctor Böving relating to the musculatory system of the abdominal segment in coleopterous larvæ, I am convinced, that the pleural suture is the key to the structural modification and homology of the pleurum in all segments of all stages of insects, and therefore largely a key to the morphology of the hexapodal type.

"All of this shows that the essential features in the development from the egg to the adult in the insects with a so-called incomplete metamorphoses is not so very different from those in insects with a so-called complete metamorphoses. Therefore much of the terminology, as applied to the primary elements of the adult, is applicable to all stages, such as the tergum with its prescutum, scutum, scutellum and postscutellum, the sternum with its presternum, sternum, sternellum and poststernellum; the pleurum with its epipleurum and hypopleurum; the epipleurum with its epimeral area, lobe or sclerite and its spiracle area, lobe or membrane; the hypopleurum with its episternal area, lobe or sclerite and its coxal area, lobe or coxa—and so on as applied to all body segments of all stages.

"It must be kept in mind, however, that there is an almost unlimited range of modification in each and all of the named elements. There is often a most complex subdivision of one, the

fusion of two or more or the suppression of one or more elements. Therefore, in order to correctly homologize and generalize, one must have a comprehensive knowledge of the manifestation of the primary elements as represented by characteristic examples of all stages in all orders."

CERATOPOGONINÆ SUCKING THE BLOOD OF CATERPILLARS

By Frederick Knab, *Bureau of Entomology.*

Under date of December 29, 1913, my friend Mr. C. A. Mosier sent me from Florida some small Diptera with the information that they were sucking the blood of a sphingid caterpillar which was feeding on the foliage of the papaya. The flies were busily sucking, while the caterpillar thrashed about and in that way succeeded in dislodging some of its enemies. The caterpillar was that of the well-known papaya sphinx, *Erinnyis ello* L. The flies, strangely enough, were of two widely different species, one of them a biting chironomid of the genus *Forcipomyia*, the other a lauxaniid of the genus *Pachycerina*. The *Forcipomyia*, of which fourteen females were sent, proves to be closely related to the Antillean *F. propinquus* Will., but distinct and undescribed, and I propose to call it *Forcipomyia erucicida*. Specimens collected by Mrs. A. T. Slosson at Lake Worth and Biscayne Bay, Florida, stood in the national collection labeled "*Culicoides eriophorus* Will." and included with them were specimens of *Forcipomyia propinquus* from Cuba. I find it necessary to mention these erroneous determinations, as they have found their way into the literature of the present subject.[1]

Prof. C. F. Baker records a biting midge attacking the caterpillars of the geometrid moth *Melanchroia geometroides* (Walker) in Cuba, swarming about them and killing large numbers of them.[2] The midges were determined by the late D. W. Coquillett as "*Ceratopogon eriophorus* Will.," but it would seem that the specimens were not preserved. As there are no true *eriophorus* in the collection, and the Cuban specimens (collected by Mr. E. A.

[1] In this connection it should be noted that Williston's description of *F. eriophorus* (Trans. Ent. Soc. Lond., 1896, p. 279) is of the female, and not of the male as there stated. The figures of the tarsus and wing of *F. propinquus* (l. c., pl. 9, figs. 41, 41a) also are of the female, instead of the male.

[2] Remarkable habits of an important predaceous fly (Ceratopogon eriophorus Will.). U. S. Dept. Agric., Bur. Ent., Bull. 67, pp. 117–118, 1907.

Schwarz at Cayamas) so labeled are *Forcipomyia propinquus*, it is safe to conclude that this last mentioned was the species observed by Professor Baker.

Doctor Lutz records two observations of *Forcipomyia* attacking caterpillars. One was by Townsend, who took specimens sucking a sphingid larva in Peru, the other by Barbiellini, who made a similar observation at São Paulo, Brazil.[3]

A further record of *Forcipomyia* attacking caterpillars comes from Prof. F. W. Urich and is published here for the first time. The observation was made in October, 1911, during Professor Urich's stay on the Isthmus of Tehuantepec. The species observed is also closely related to *F. propinquus* and I propose to call it *Forcipomyia crudelis*.

These records of closely related species of *Forcipomyia* attacking caterpillars would lead one to suppose that these flies feed exclusively on lepidopterous larvæ, and the writer was inclined to adopt this view. However, among a number of specimens of *Forcipomyia propinquus*, taken by Mr. A. Busck in the island of Santo Domingo, was a female bearing a label indicating that it had inflicted a painful bite on the collector. Also, the writer, while at Miami, Florida, took two females of *F. erucicida*, along with other Ceratopogoninæ, on the flowers of an avocado (*Persea* sp.). Thus there is a wide range of feeding habits indicated, which does not, however, preclude decided food predilections on the part of these insects.

It may be further pointed out that Ceratopogoninæ have been observed attacking adult insects. F. H. Gravely, in India, found a specimen of *Culicoides* attacking an *Anopheles* mosquito, the former having its proboscis so firmly fastened in the abdomen of the mosquito that it remained attached when the catch was placed in alcohol.[4] It must be pointed out that some species of *Culicoides* are very troublesome blood-suckers of man and of other warm-blooded animals, so that Gravely was well justified in thinking that his *Culicoides* probably normally "sucks mammalian blood, and was taking it second-hand from the mosquito." But more recent observations, made by Major N. P. O'Gorman Lalor in Lower Burma, show that these attacks of Ceratopogoninæ upon mosquitoes are far too frequent to be accounted for in this way. In these observations three species of *Anopheles* were found to be attacked. Caught specimens of *Anopheles fuliginosus* "have been found infested to the extent of 6 per cent, and this probably implies a much wider infestation of that species in nature."[5]

[3] Mem. Inst. Oswaldo Cruz, IV, p. 24, 1912.

[4] Mosquito sucked by a midge. Records Indian Mus., IV, p. 45, 1911.

[5] Note on a parasitic fly which infests malaria carrying Anopheles in Lower Burma. Paludism (Simla), no. 5, pp. 42–43, 1912.

Recently I have had the priviledge of examining specimens of a species of *Ceratopogon* (restricted sense) captured by Mr. I. P. Kryger in Denmark while fastened to the wings of a geometrid moth (*Cidaria didymata* L.). So tightly had the small flies inserted their beaks into the wing-veins of the moth that they remained in position long after they had been introduced into the killing-bottle and death had followed.[6] Of course the moth must have been a recently emerged one, in which the blood was still present in the wing-veins. The midges belong in the neighborhood of *Ceratopogon murinus* Winnertz, but I have been unable to place them satisfactorily and they are probably an undescribed species.

As to the *Pachycerina* captured by Mr. Mosier along with the *Forcipomyias* on the caterpillar of the papaya sphinx, nothing appears to be known of their habits. Probably they were attracted by the blood exuding from the injured caterpillar, and were not participants in the primary attack of the *Forcipomyias*. The species was represented in the national collection by a single specimen taken by Mrs. Slosson at Biscayne Bay, Florida, and determined by D. W. Coquillett as *Pachycerina flavida* Wiedemann.

Forcipomyia erucicida n. sp.

Female: Occiput dull brown, clothed with coarse yellow hairs. Antennæ with the shaft yellowish, shading to brownish distally, the proximal joints subglobose and subovate, the last five lengthened, subcylindrical. Palpi black, the antepenultimate segment thickened, the penultimate nearly as long, slender, subcylindrical, the last joint short. Thorax and scutellum brownish black, a pale spot on the humerus, clothed with coarse, shining yellow hair. Postnotum black. Abdomen black, clothed with blackish hairs with yellow luster. Wings smoky, clothed with coarse black hairs, a patch of yellow hairs at base of costa; subcostal cell thickened and strongly pigmented, its distal end slightly beyond the middle of the wing. Halteres with white knob. Legs yellowish, clothed with coarse, irregular yellow hairs, a broad blackish ring at the ends of the middle and hind femora, a narrower blackish ring close to base of the corresponding tibiæ; tarsi tinged with brown, slender, the first joint of the hind pair about half the length of the second, last joint slightly thickened, subcylindrical. Claws long and slender; empodium fleshy, ciliate. Length: Body about 2 mm., wing 2 mm.

Male: Antennæ plumose, luteous brown, the tori very large, the proximal joints of the shaft subglobose. Palpi considerably longer than in the female. Abdomen slender, elongate, black, with broad pale segmental rings on the proximal half; lateral ciliation of long and coarse brown hair

[6] En Myg, der angriber en Sommerfugl. Ent. Meddel., pp. 83–88, 1914.

with yellow luster. Wings narrower than in the female. Length: Body about 3 mm., wing 1.8 mm.

Buena Vista, Florida, December 29, 1913 (C. A. Mosier); Miami, Florida, two females on flowers of avocado (*Persea* sp.), December 20, 1912, two males, November 22 and 23, 1912 (F. Knab); Little River, Florida, two females November 30, 1912 (Knab); Biscayne Bay and Lake Worth, Florida (Mrs. A. T. Slosson).

Type: Cat. No. 18419, U. S. N. M.

Closely resembles *Forcipomyia propinquus* Williston, but differs principally in the shape of the palpi and hind tarsi, both being more slender than in Williston's species.

Forcipomyia crudelis n. sp.

Female: Occiput dull brown, clothed with coarse yellow hair. Antennæ with the proximal portion of the shaft yellowish, of subglobose and subovate joints, the last five joints blackish and clothed with white pubescence, elongate and subcylindrical. Palpi black, the antepenultimate joint greatly thickened. Thorax and scutellum brownish black, a small yellowish humeral spot, vestiture of coarse yellow hair. Abdomen black, clothed dorsally with dark hair, at the sides with tufts of shining yellow hair at the bases of the segments. Wings smoky, clothed with coarse black hair; costa black to end of first vein and on this portion bearing long and dense black hair, a patch of yellow hair at its base; submarginal cell indistinct, ending slightly beyond middle of wing. Halteres with brownish stem and whitish knob. Legs yellow, clothed with coarse, irregular yellow hairs; an ill-defined brown ring subapically on middle and hind femora; entire fore tarsi infuscated, middle and hind tarsi with the last three joints dark; first joint of hind tarsi slightly less than half the length of the second, the last joint nearly as long as the fourth. Claws long and slender; empodium fleshy, ciliate. Length: Body about 1.5 mm., wing 1.7 mm.

Plantation "La Oaxaqueña," near Santa Lucrecia, Mexico, October, 1911. (F. W. Urich.)

Type: Cat. No. 18420, U. S. N. M.

NOTES ON SOME FOREST COLEOPHORA WITH DESCRIPTIONS OF TWO NEW SPECIES.[1]

By Carl Heinrich, *Bureau of Entomology.*

The following species of *Coleophora* were reared by Mr. A. Busck and the writer during the past summer, at the Falls Church, Virginia, station of the Forest Insect Investigations Division of

[1] Contribution from the Division of Forest Insect Investigations, Bureau of Entomology.

the Bureau of Entomology. The writer is indebted to Mr. Busck for final determination of the species.

Coleophora leucochrysella Clemens. Dyar N. A. Lp. No. 6026.

Eleven specimens of this beautiful moth were reared under Hopkins U. S. No. 11135.

Larval case 10 to 11 mm. long; first two-thirds made from material of the leaf; light yellow; elongate cylindrical, somewhat flattened and slightly bulged in the middle with distinct fin-like projection from base to middle; mouth deflected about 30 degrees; posterior third made of pure silk, slightly darker, curving in to a blunt point and splitting vertically along the posterior extremity of the keel.

Habitat: Falls Church, Virginia, and Charter Oak, Pennsylvania.
Foodplant: Castanea dentata
The larva mines the leaves from the under surface. The clear, rectangular mine with the small circular entrance on the under side clearly distinguishes the work of the species. A number of full grown larvæ collected at Falls Church, Virginia, during the early part of May, by Mr. Busck and the writer, pupated June 2, the adult moths issuing June 16 to 20. The larvæ overwinter in the cases, which are attached to the twigs or the bark of the tree, and feed up during the following May.

Two new species of Hymenopterous parasites of the larvæ (*Microdus* sp. and *Microbracon* sp., determined by Mr. S. A. Rohwer) were reared from larvæ collected at Falls Church, and from a couple of larvæ collected at Charter Oak, Pennsylvania, by Mr. T. E. Snyder, of the Bureau of Entomology.

Coleophora carpinella n. sp.

Palpi grayish white tinged with brownish ochreous. Antennæ slightly thickened and clothed with brownish ochreous scales to basal fourth; white beyond and distinctly annulated with deep brown. Face and head brownish ochreous shading to white. Fore-wings deep brown with darker dustings in apical portion and with white streak along costa from base to costo-apical cilia, narrowing and faintly visible beyond first third and bordered with brown on extreme costal margin; cilia shaded from brownish ochreous on costo-apical to lead gray on dorso-apical portions. Hind-wings dull steel gray, cilia steel gray along costal and lead gray along dorsal margins with lighter shadings toward base of wing. Abdomen brown dusted with grayish white above and beneath; anal tuft slightly paler brown. Legs light brown on outer, white on inner side, tarsi annulated with darker brown. Alar expanse: 7 to 7.5 mm.

Habitat: Hyattsville, Maryland.
Foodplant: Carpinus.

Type: Cat. No. 18183, U. S. N. M.

Described from seven specimens reared June 28, to July 12, 1913, under Hopkins U. S. No. 11143 from larvæ feeding on leaves of *Carpinus*. There are also three specimens of the same species in the U. S. National Museum, reared by Mr. Busck in 1901 from the same food plant.

The larval case is dark brown, smooth; 6 to 7 mm. long and 1 to 1.5 mm. wide; cylindrical in form with posterior end flattened and slightly wider than diameter of the case; mouth slightly deflected.

This species resembles *C. caryæfoliella* Clemens, from which it differs in its smaller size, the dark apical dusting on fore-wings, the generally darker color of wings and cilia and the greater deflection of the mouth of the larval case.

Coleophora alniella n. sp.

Palpi white very faintly tinged with ochreous. Antennæ white, annulated with golden brown; base slightly thickened with scales, white to ochreous, not erected. Face and head golden ochreous shading to white on sides. Fore-wing nearly a uniform golden brown with white streak along costa from base to costo-apical cilia; cilia shading from white at end of costal streak to golden brown on dorso-apical margin. Hind-wings and cilia steel gray with faint golden tints. Abdomen brown with argentious dustings above and beneath. Legs light golden brown on outer, silvery on inner side; tarsi but faintly annulated. Alar expanse: 8 to 9 mm.

Habitat: Hyattsville, Maryland.

Foodplant: Alnus.

Type: Cat. No. 18184, U. S. N. M.

Described from three specimens reared June 30 and July 5, 1913, under Hopk. U. S. No. 11139, from larvæ feeding on leaves of *Alnus*.

The larval case is dark brown, rather rough and fibrous; 6 to 7 mm. long by 1.5 mm. wide; a slightly flattened cylinder in form, with posterior end flattened to somewhat curved edge like the blade of an axe; mouth deflected to 90 degrees.

This species so closely resembles *C. caryæfoliella* Clemens, that it is difficult to separate the two on adult characters. I find quite a little variation in the specimens of the hickory species before me, so that whatever very slight size and color differences there are, offer no sure means of differentiating the species. It seems however, that in this case the differences in the foodplant and larval cases should be sufficient to warrant the erection of a new species.

The chief structural differences are in the posterior end and mouth of the case. In *caryæfoliella* the posterior end is flattened to a straight line, and the mouth deflects to about 40 degrees.

In *alniella* the posterior end is flattened to a slightly curved line and the mouth deflects to about 90 degrees. These differences are constant in all the specimens that have come under my observation.

Coleophora querciella Clemens. Dyar List N. A. Lep. No. 6040.

Palpi white with very fine golden brown dustings on apical segment. Antennal base clothed above with a long projecting tuft; white, intermarked with golden brown. Antennæ white, annulated beyond basal fourth with light brown. Face and head white. Fore-wings white with apical dustings shading from golden brown to black; cilia black on costo-apical portion to silver gray on dorsal margin. Hind-wings and costal cilia of same, argentious with faint golden overtone; dorsal cilia somewhat darker. Abdomen white. Legs white with faint brownish markings; tarsi not annulated. Alar expanse: 12 mm.

Habitat: Falls Church, Virginia.
Foodplant: Quercus.

Two adults reared under Hopk. U. S. No. 11135c and 11135d from larvæ collected on *Quercus prinus* and *Quercus alba*. Moths issued June 21 and 25, 1913. I had considerable misgiving about the identity of the species, as Clemens knew it only in the larval stage and his description of the larval case, while corresponding in nearly all details with the specimens before us, is misleading in one point. He describes the posterior end as "squarely excised," while as a matter of fact it curves inward to a blunt point, similar to *C. leucochrysella* Clemens. Larval case 9 mm. long.

THE SPECIES OF PERILAMPIDÆ OF AMERICA NORTH OF MEXICO.

By J. C. Crawford, *U. S. National Museum.*

The species in this family fall in three genera *Euperilampus*, *Perilampus*, and *Chrysolampus*. The species which Ashmead referred to the genus *Elatus* must be transferred to *Chrysolampus* since it has only one ring joint and Walker's original description of *Elatus* characterizes that genus as having two ring joints.

Genus Euperilampus Walker.

The only species of this genus occurring north of Mexico is *E. triangularis* Say. *E. opacus* Ashm. is a *Eurytoma*, Doctor Ashmead being misled by a piece of extraneous matter which had adhered to the scutellum.

Genus Perilampus Latreille.

TABLE OF SPECIES.

1. Face with a carina from anterior ocellus running laterad and turning downward on each side and extending to, or almost to, the level of insertion of antennæ 2
   Face without such carina or at most an indistinct one running only laterad from anterior ocellus 7
2. Species distinctly greenish, bluish or coppery 3
   Species black or aeneous 4
3. Green or bluish, facial carina prominent, upper part of face between carina and eyes vertically striate; below from eyes to mouth-parts strongly rugose .... *hyalinus* Say
   Bronzy, facial carina delicate, upper part of face almost smooth, lower part with only a few wrinkles .... *subcarinatus* n. sp.
4. Face strongly produced, a line connecting lower margins of eyes being some distance above upper margin of clypeus .... *robertsoni* n. sp.
   Face not strongly produced, upper margin of clypeus about on a level with lower end of eyes 5
5. Face in front of malar furrow rugose-granular 6
   Face in front of malar furrow smooth .... *carinifrons* n. sp.
6. Parapsidal areas reticulate, upper part of face between carina and eyes reticulate .... *platygaster* Say
   Parapsidal areas and upper part of face between carina and eyes smooth *bakeri* n. sp.
7. Third joint of antennæ as long as wide .... *anomocerus* n. sp.
   Third joint of antennæ much shorter than wide 8
8. Wings under marginal veins with a large infuscated cloud *stygicus* Provancher
   Wings without such a cloud 9
9. Malar furrow distinctly longer than width of malar space at apex *similis* n. sp.
   Malar furrow shorter than width of malar space at apex 10
10. Sides of face above vertically wrinkled; in male the wrinkles extending downward to level of insertion of antennæ .... *chrysopæ* n. sp.
    Sides of face smooth 11
11. Punctures along middle line of mesoscutum and scutellum well separated .... *granulosus* n.sp.
    Punctures of middle of mesoscutum and scutellum close 12
12. Small less than 3 mm. face above gently curved .... *fulvicornis* Ashmead
    Large, about 4 mm., face above produced, angulated from anterior ocellus laterad and no true carina beyond, simulating one being sharply angulated .... *canadensis* n. sp.

Perilampus subcarinatus n. sp.

Female: Length 3 mm. Dark olive green; facial carina delicate, reach-

converging toward clypeus, behind the malar furrow with similar more distinct rugulæ extending in the same general direction; ocellar triangle transversely rugulose; pronotum and mesonotum coarsely rugoso-punctate, inner margin of parapsidal areas with a broad smooth band; scutellum with the apex emarginate; legs green, bases and apices of tibiæ, underside of anterior tibiæ and tarsi testaceous.

Type-locality: San Bernardino County, California.
Type-specimen: Cat. No. 18298, U. S. N. M.
Described from two specimens collected in May.

Perilampus robertsoni n. sp.

Female: Length about 2.5 mm. Black, face smooth, malar furrow distinctly longer than width of malar space at apex, facial carina indistinct beyond the point where it turns downward along inner orbits; ocellar triangle rugulose, in front of lateral ocelli indistinctly rugulose; pronotum and mesonotum coarsely rugoso-punctate; inner margins of parapsidal areas with a broad smooth area; scutellum at apex slightly emarginate; legs black, the knees, bases and apices of tibiæ and the tarsi testaceous.

Male: Length about 2.5 mm. Similar to the female but the malar space vertically lineolate; the facial carina distinct almost to lower margin of eyes; ocellar triangle and the areas in front of lateral ocelli more distinctly sculptured than in female.

Type-locality: Southern Illinois.
Type-specimen: Cat. No. 18299, U. S. N. M.
Described from one female and two males collected by Mr. Chas. Robertson and bearing his Nos. 9729 (type female), 9841 (allotype), 9730 (paratype).

This species is named in honor of the collector and is readily distinguished from the other species by the elongate face.

Perilampus carinifrons n. sp.

Female: Length about 3.25 mm. Black, facial carina extending only slightly below middle of anterior orbits; face smooth, malar space vertically lineolate; antennæ dark brown, scape black; ocellar triangle indistinctly transversely rugulose, pro- and mesonotum coarsely rugoso-punctate, inner edge of parapsidal areas with a broad smooth band; legs black, the knees reddish, tarsi testaceous.

Male: Length about 2 mm. Similar to the female but the funicle ferruginous beneath; the tibiæ obscurely reddish.

Type-locality: Kerrville, Texas.
Other localities: Corpus Christi, Beeville, and Dallas, Texas.
Described from four females and two males; types collected by F. C. Pratt, June 19, 1907; two females from Corpus Christi collected October 16, 1908, by Messrs. J. D. Mitchell and F. C.

Bishopp; a male from Beeville, Texas, September 7, J. D. Mitchell, collector; a female from Dallas, Texas, October 12, 1905, F. C. Bishopp, collector.

Type-specimen (female): Cat. No. 18300, U. S. N. M.

Perilampus bakeri n. sp.

Female: Length about 3 mm. Black, facial carina extending about to level of insertion of antennæ, below this the sides of face granular; posterior orbits vertically lineolate; face between carina and inner orbits very indistinctly finely wrinkled, at upper end of orbit more granular; ocellar triangle with a few transverse striæ; antennæ dark brown; pro- and mesonotum coarsely rugoso-punctate, inner margin of parapsidal areas with a broad smooth band; scutellum at apex sub-emarginate; legs black, knees, bases and apices of tibiæ, a stripe on rear of front tibiæ and all tarsi reddish testaceous.

Male: Length about 3 mm. Similar to the female but the antennæ ferruginous beneath; the sculpture of the face stronger; the sides of the face between the facial carinæ finely vertically rugulose, between the carina and the eye more distinctly sculptured than in female, the upper portion being distinctly granular.

Type-locality: Colorado.

Type-specimen: Cat. No. 18301, U. S. N. M.

Described from four females and two males from the C. F. Baker collection, type female bearing the No. 2044, the allotype No 1584, one female and one male paratypes No. 1591, one female, No. 1596, and one, No. 1630.

Perilampus anomocerus n. sp.

Female: Length about 2 mm. Green, with the thorax above coppery and the abdomen so dark as to appear almost black; face produced, the malar furrow slightly longer than the width of the malar space at apex; upper margin of the clypeus slightly below the level of the lower margin of eyes; face rather densely pubescent, each hair situated in a distinct puncture; anterior portion of the malar space smooth, posterior part vertically rugulose; scape green, rest of antennæ ferruginous, above brownish; ring-joint distinctly as long as broad; mesonotum coarsely umbilicately punctured, the punctures well separated especially along median line, the space between the punctures finely lineolate; medial half of parapsidal areas smooth, polished; wings hyaline, with a small indistinct brownish spot at apex of submarginal vein; femora, except apices, greenish, tibiæ and tarsi reddish testaceous.

Allotype: Length about 2 mm. Similar to the female except in secondary sexual characters.

Type-locality: Colorado.

Type-specimen: Cat. No. 18302, U. S. N. M.

Described from nine females and two males from a large series in the C. F. Baker collection, the types and one paratype female with his No. 1584, the paratype male and one female with his No. 2044, one No. 2084, one No. 2158, and four, No. 1591.

Perilampus similis n. sp.

Female: Length about 2 mm. Black, with a more or less distinct greenish tinge on head and thorax; very similar to *P. anomocerus*, having a similar produced face but the ring-joint very short, distinctly less than half as long as broad; femora black, tibiæ and tarsi reddish testaceous, the tibiæ all with a dark brown stripe above.

Type-locality: Colorado.
Type-specimen: Cat. No. 18303, U. S. N. M.
Described from four specimens from the C. F. Baker collection, all bearing his No. 2041.

Perilampus chrysopæ n. sp.

Female: Length about 2 mm. Green, malar furrow about half as long as width of malar space at apex; upper part of face wrinkled; ocellar triangle transversely rugose; scape greenish, flagellum ferruginous with the base somewhat brownish; pro- and mesonotum coarsely, closely rugosopunctate, inner half of parapsidal areas smooth; scutellum at apex emarginate; legs greenish, knees, bases and apical portion of tibiæ and tarsi testaceous.

Male: Length about 2 mm. Similar to the female but the sculpture of the face much stronger and extending half way down anterior orbits; antennæ above brown.

Type-locality: Batesburg, South Carolina.
Type-specimen: Cat. No. 18304, U. S. N. M.
Described from seven females and six males reared from cocoons of *Chrysopa* sp. with the Bureau of Entomology, U. S. Department of Agriculture Hunter No. 3414.

Perilampus granulosus n. sp.

Female: Length about 2 mm. Green, malar furrow almost as long as the width of malar space at apex; flagellum ferruginous; pedicel brown; scape with a distinct greenish tinge; pro- and mesonotum coarsely umbilicately punctured, the punctures well separated especially medially where they are more than half a puncture width apart, the space between punctures on rear of mesoscutum and on scutellum smooth; laterad on scutellum, parapsidal areas and middle lobe of mesoscutum between the punctures the surface is granular; inner edge of parapsidal areas with a broad smooth band; femora brown, their apices, the tibiæ, and tarsi reddish testaceous.

Male: Length about 2 mm. Similar to the female except in secondary

sexual characters but the granular areas on the mesonotum extend further centrad.

Type-locality: Alabama.
Type-specimen: Cat. No. 18305, U. S. N. M.
Described from one female and two males from the C. F. Baker collection; female with his No. 1967, allotype with his No. 2497, and the paratype, No. 1912.

Perilampus canadensis n. sp.

Female: Length about 4 mm. Black, with a distinct bronzy luster on the mesonotum; antennæ dark, apically becoming obscurely ferruginous; vertex produced, sharply angulated, appearing, unless examined closely, carinate as in the species which have a facial carina; sides of face and malar space below with a few coarse punctures, malar furrow somewhat more than half as long as width of malar space at apex; ocellar triangle transversely rugulose; pro- and mesonotum coarsely, closely rugoso-punctate, inner edge of parapsidal areas with a broad smooth band; legs black, tarsi testaceous.

Male: Length about 4 mm. Similar to the female but more distinctly bronzy, and the head bronzy; femora distinctly greenish; tibiæ obscurely ferruginous.

Type-locality: Canada.
Type-specimen: Cat. No. 18306, U. S. N. M.
Described from one male and one female from the C. F. Baker collection; the female with his No. 2021, the male, No. 2066.

This species, owing to the produced vertex, resembles the species belonging to the other section of the genus but careful examination shows that the face bears no real carina, the sharp angulation of the produced portion merely simulating a carina.

Genus Chrysolampus Spinola.

Doctor Ashmead considered *Lamprostylus* as a synonym of *Chrysolampus* and this synonomy is here adopted. *L. floridanus* Ashm., however, is a species of the genus *Eurytoma*, and is consequently omitted.

TABLE OF SPECIES.

1. Mesoscutum and scutellum coarsely rugoso-punctate........*lycti* n. sp.
   Mesoscutum not as above, either with well separated punctures or finely rugulose........ 2
2. Mesoscutum transversely rugulose........*sisymbrii* Ashm.
   Mesoscutum punctured........ 3
3. Scutellum parapsidal areas and pronotum above, except anteriorly, almost entirely impunctured........*parcipunctatus* n. sp.
   Scutellum and pronotum almost covered with punctures...*schwarzi* n. sp.

Chrysolampus lycti n. sp.

Female: Length about 2.75 mm. Dark bronzy with the head green and the abdomen so dark as to appear almost black; sides of face below level of insertion of antennæ obliquely rugose, above smooth, rear of head circularly rugose with the posterior orbits smooth; parapsidal areas smooth, the outer margin with about two rows of very coarse punctures, sculpture of the median lobe of mesoscutum and of scutellum is in reality umbilicate punctures but they are so coarse and crowded as to become reticulately rugose; scutellum before apex with a transverse carina and back of this one row of longitudinal carinæ; propodeum reticulately rugose, medially with a longitudinal carina; femora brown, with a greenish luster, posterior ones more green; knees, tibiæ and tarsi reddish testaceous, the posterior tibiæ brown except bases and apices; abdomen smooth.

Male: Length about 2.5 mm. Similar to the female but the face above level of insertion of antennæ is vertically rugulose.

Type-locality: Top of the Alleghanies, Pocahontas County, West Virginia.

Host: Lyctus striatus.

Type-specimen: Cat. No. 18307, U. S. N. M.

Described from one female and seven males collected by Dr. A. D. Hopkins and recorded under his West Virginia note No. 5781.

This is the species recorded in Bulletin 32, West Virginia Agricultural Experiment Station by Dr. A. D. Hopkins as *Perilampus hyalinus* Say, the determination being made by Doctor Ashmead.

Chrysolampus parcipunctatus n. sp.

Female: Length about 3 mm. Green, face below level of insertion of antennæ with fine oblique striæ which at insertion of antennæ curve and extend upward for a short distance but are much more indistinct than the oblique portion; face with large scattered punctures; posterior surface of head very finely circularly striate; pronotum with scattered large punctures, viewed from above the visible portion except at extreme base almost impunctured; middle lobe of mesoscutum basally transversely rugulose and with scattered large punctures; parapsidal areas with a few punctures outwardly and a few along inner line; scutellum with a few large punctures basally and along lateral margins; propodeum with medial longitudinal carinæ, very finely substransversely rugulose; petiole about as long as propodeum, with a median longitudinal carina, the sculpture about as coarse as that on propodeum; coxæ and femora green; apices of femora, tibiæ and tarsi reddish testaceous, tibiæ with a brownish spot medially.

Type-locality: Los Angeles County, California.

Type-specimen: Cat. No. 18309, U. S. N. M.

Described from one specimen collected in April.

Chrysolampus schwarzi n. sp.

Female: Length 4 mm. Green, face above level of insertion of antennæ vertically rugulose, at insertion of antennæ curving inward and becoming oblique, the face also having scattered punctures; the clypeus smooth with a few scattered punctures; vertical striæ on face reaching almost to level of anterior ocellus, above this the face smooth except for the scattered punctures; rear of head semicircularly rugulose; pronotum with coarse punctures separated by about half a puncture width; middle lobe of mesoscutum at extreme base transversely rugulose, rest of surface with punctures about as close as on pronotum and between them the surface on the anterior part transversely rugulose; parapsidal areas anteriorly transversely rugulose with scattered large punctures; scutellum with large punctures but with the medium line almost impunctured; propodeum irregularly rugulose, petiole about as long as the propodeum, with a median longitudinal carina, surface irregularly rugose; coxæ and femora green, tibiæ bronzy with the bases and apices reddish testaceous.

Type-locality: Wasatch, Utah.

Described from two specimens collected June 27, 1891, by Mr. E. A. Schwarz.

Type-specimen: Cat. No. 18308. U. S. N. M.

The manuscript name used by Doctor Ashmead is adopted.

O. M. REUTER.

By Otto Heidemann, *Bureau of Entomology.*

Dr. O. M. Reuter, entomologist, poet and philosopher, one of our foremost hemipterists, died on September 2, 1913, in Abo, Finland, his native town, at the age of sixty-three years.

Five years before his death his eyesight became impaired and during the last two years he was totally blind. In spite of failing eyesight he contemplated new studies in some groups of the Hemiptera and finished some of his manuscripts with the aid of his assistant, Dr. B. Poppius.

In his last letter written in September, 1912, Doctor Reuter said: "I intend to finish my work on the Termatophylidæ and have the paper published in Wytsman's Genera Insectorum, also the genera of Cimicidæ."

His chief study was the large and very difficult family of the Capsidæ (or Miridæ of some authors). Besides numerous Palæarctic species, he described 56 new species of North American Capsids as early as 1875, and 78 more new species in his publication on Neartic Capsidæ in 1909. In 1905, appeared his classification of the Capsidæ (Hemipterologische Speculationen); but the

most important work he published in recent years was an essay written in German "Neue Beiträge zur Phylogenie and Systematik der Miriden, 1910."

He described many North and South American, Mexican and West Indian Capsidæ and some new North American species of the families Pentatomidæ, Anthocoridæ, Nabidæ and Reduvidæ.

It was his good fortune to possess great energy and working power, which enabled him, while performing his duties as an instructor in zoology at the University of Helsingfors, to publish nearly 500 papers upon the subject of entomology.

The following is a list of papers on American Hemiptera published by Doctor Reuter:

Acanthiidæ americanæ. Öfv. K. Vet. Ak. Förh., 1871, p. 557-568.

Capsinæ ex America boreali in Museo Holmiensi asservatæ. Öfv. K. Vet. Ak. Förh., 1875, no. 9, Stockholm.

Monographia generis Oncocephalus proximeque affinium. Act. Soc. Sc. Fenn., XII, 1883, pp. 675-758.

Monographia Anthocoridarum orbis terrestris. Act. Soc. Sc. Fenn., XIV, 1884, pp. 555-758.

Monographia Ceratocombidarum orbis terrestris. Act. Soc. Sc. Fenn., XIX, no. 3, 1891, p. 28.

Voyage de M. E. Simon au Venezuela. Ann. Soc. Ent. Fr., XLI, 1892, pp. 391-402.

Zur Kenntniss der Capsiden Gattung Fulvius Stal. Ent. Tidskr., XVI, 1895, pp. 129-154.

Species palæarcticæ generis Acanthia Fabr. Latr. Act. Soc. Sc. Fenn., XXI, no. 2, 1895.

Miscellanea Hemipterologica. Öfv. Fin. Vet. Soc. Förh., 1902, pp. 141-188.

Monographia Generis Heteropterorum Phimodera Germ. Act. Soc. Sc. Fenn., XXXIII, no. 8, 1905.

Hemipterologische Speculationen 1 (Die Klassification der Capsiden). Festschrift für Palmén, no. 1, Helsingfors, 1905.

Capsidæ Stalianæ secundum specimina typica redescriptæ I, II. Öfv. Fin. Vet. Soc. Förh., no. 12, 1905.

Capsidæ in Venezuela a Fr. Meinert collectæ enumeratæ novæque species descriptæ. Öfv. Fin. Vet. Soc. Förh., no. 20, 1905.

Capsidæ novæ in insula Jamaica. Öfv. Fin. Vet. Soc. Förh., XLIX, 1906-1907, no. 5.

Capsidæ in Brasilia collectæ. Annalen des K. K. Naturhistorischen Hofmuseums, Bd. XXII, Heft. 1, 1907.

Eine neotropische Capside als Orchideenschädling in Europäischen Warmhäusern. Zeitschrift für wissenschaftliche Insectenbiologie, Bd. III, 1. Folge, Bd. XII, 1907, Heft. 8, pp. 251-254.

En nordamerikansk hemipter funnen in Norge. Ent. Tidskr., XXVIII, 1907, pp. 81-82.

Capsidæ tres cubanæ. Capsidæ mexicanæ. Capsidæ quinque novæ in Tombillo (Chile) lectæ. Annalen das K. K. Naturhistorischen Hofmuseums, Bd. XXII, 1907.

Capsidæ Argentinæ. Öfv. Fin. Vet. Soc. Förh., LI, 1908–1909, Afd. A. no. 13.

Genera quatuor nova divisionis Capsidarum Restheniaria. Öfv. Fin. Vet. Soc. Förh., LI, 1908–1909, no. 24.

Capsidæ tres novæ in Brasilia a R. F. Sahlberg collectæ. Öfv. Fin. Vet. Soc. Förh., LI, 1908–1909, no. 25.

Anthocoridæ novæ, III Regio neotropica. Öfv. Fin. Vet. Soc. Förh., LI, 1908–1909, no. 26.

Hemisphærodella mirabilis n. gen. et sp. Wiener Entomologische Zeitung, XXVII, Jahrg., Heft. IX and X, 1908.

Bemerkungen über Nabiden nebst Beschreibung neuer Arten. Mémoires de la Société entomologique de Belgique, Tom. XV, 1908.

Bemerkungen über Nearctische Capsiden nebst Beschreibung neuer Arten. Act. Soc. Sc. Fenn., Tom. XXXVI, no. 2, 1909.

Monographia Nabidarum orbis Terrestris (O. M. Reuter et B. Poppius), Pars prior cum Tabula colorata. Act. Soc. Sc. Fenn., Tom. XXXVII, no. 2, 1909.

Neue Beiträge zur Phylogenie and Systematik der Miriden. Act. Soc. Sc. Fenn., Tom. XXXVII, no. 3, 1910.

Diagnoses præcursoriæ Miridarum Divisionis Restheniaria. Annales Musei Nationalis Hungarici, VIII, 1910.

Bemerkungen über mein neues Heteropterensystem. Öfv. Fin. Vet. Soc. Förh., Bd. LIV, 1911–1912, no. 6.

Hemipterologische Miscellen. Öfv. Fin. Vet. Soc. Förh., Bd. LIV, 1911–1912, no. 7.

Zur generischen Teilung der palaearctischen and nearktischen Acanthiaden. Öfv. Fin. Vet. Soc. Förh, Bd. LIV, 1911–1912, no. 12.

Über Sixeonotus luteiceps Reut., und Beschreibung einer neuen Bryocorine (Hem. Het.). Annales de la Soc. Ent. de Belgique, Tom. LVII, 1913.

A NEW SPECIES OF THE BRACONID GENUS PHANEROTOMA WESMAEL.

BY R. A. CUSHMAN, *Bureau of Entomology.*

Phanerotoma recurvariæ n. sp.

Female: Length 3 mm. Flavous, somewhat paler medially on first and second tergites, wings hyaline. Face, vertex and posterior orbits finely shagreened, clypeus smooth, somewhat paler than face, outline laterally and apically with brown, the suture straight, mandibles pale outlines and tipped with brown; occiput behind ocelli finely, transversely striate; eyes large, the malar space hardly one-fourth as long as the greatest diameter

of the eyes, ocelli situated in a blackish spot; antennæ flavous with dark tips, scape large, as long as pedicel and first flagellar joint together, last four joints of flagellum bead-like; thorax finely shagreened and clothed with short, fine, silvery pubescence; propodeum with an irregular transverse carina and an indistinct triangular areola, the posterior face irregularly, longitudinally striate; wings hyaline, veins brown except in middle of wing, where they are pale, stigma and parastigma pale more or less infuscated behind; coxæ, trochanters, tibiæ basally, and anterior femora whitish, apical tarsal joints blackish, apex of posterior tibiæ somewhat infuscated, legs otherwise concolorous with the body; carapace except apically on the third tergite distinctly, coarsely, longitudinally striate, apically and between the striæ shagreened, deeply, roundly emarginate at apex, venter whitish.

Male: Differs from the female prinicipally in having the scape relatively shorter, the flagellar joints beyond the middle longer, and the emargination of the carapace less pronounced.

Type: Cat. U. S. Nat. Mus. No. 18417.
Type-locality: Benton Harbor, Michigan.
Host: Recurvaria nanella Hübn.
Described from four females and four males reared June 24, 1913 by J. H. Paine of the Bureau of Entomology, under Quaintance No. 10602.

Dr. J. M. Aldrich addressed the Society informally on the use by Indians of the west of larvæ of a species of the genus *Coloradia* as food, and exhibited specimens.

CONCERNING SOME APHELININÆ.[1]

By L. O. Howard.

Genus Mesidia Foerster.

Mesidia Foerster. Hymenopterologische Studien, Heft. 2, 1856, p. 30.

The genus *Mesidia* was founded by Foerster on page 30 of his Hymenopterological Studies, second part (1856) but he mentioned no species. Kirchner, in his Catalogue of the Hymenoptera of Europe (1867) lists, on page 143, *Mesidia pallida* Kirch., and in a footnote states that as Foerster founded the genus and kept his species in manuscript which was never published he takes the liberty of giving a specific name to help establish the genus. In this condition the genus rested until 1904, when Gustav Mayr

[1] Presented at the meeting of April 2, 1914.

described *Mesidia pumila* in the third number of his Hymenopterological Miscellanies from a specimen taken by Doctor Foerster, and this may have been the type of the genus for all we know to the contrary. Mayr does not mention whether the club of the antenna is solid or is jointed. Ashmead, in his Classification of the Chalcid Flies, assumes that it is solid and gives the antennæ of *Mesidia* as six-jointed. In Technical Series No. 12, part IV, New Genera and Species of Aphelininæ, the writer described *Mesidia mexicana* n. sp., and erroneously, in his table of genera, stated that the antennæ are seven-jointed; the same error was perpetuated in the figure. Reexamination of the type shows that the antennæ are really eight-jointed, the club being distinctly three-jointed.

The matter now becomes complicated from the finding of a single slide of a Mesidia-like form bred by Prof. C. P. Gillette at Fort Collins, Colorado, from *Brachycolus tritici*, which possesses all of the characters of *Mesidia* with the exception that the club is solid.

Inasmuch as Mayr did not state in so many words that the antennal club of *M. pumila* is solid, although the presumption would be in favor of solidity, the writer by letter begged his friend, Dr. Anton Handlirsch of the Vienna Museum, to which institution Mayr's collection went after his lamented death, to examine the type, with the result that Handlirsch found the club to be solid. Therefore the species named by Gillette is a true *Mesidia* (and is described below), while the writer's *Mesidia mexicana* becomes the type of a new genus which is also here described under the name *Dirphys*.

Mesidia gillettei n. sp.

Female: Length 1.02 mm.; expanse 2.77 mm.; greatest width of fore-wing 0.44 mm. General color dull honey-yellow, legs and antennæ concolorous with body or perhaps a little lighter, the 2 terminal tarsal sclerites of each leg darker. Pedicel and first and second funicle joints subequal in length, third funicle joint somewhat shorter; club about as long as second and third funicle joints together, somewhat laterally pointed at apex when seen at side; eyes hairy. Wings broad, veins distinctly honey-yellow, stigmal vein very short; oblique hairless streak broad and distinct, widening somewhat towards base. Abdomen ovate, a trifle broader than thorax and about as long; ovipositor not exserted.

Male: Unknown.

Type: No. 18322, U. S. N. M.

Described from a single female reared by C. P. Gillette, October 13, 1908, from *Brachycolus tritici*, presumably at Fort Collins, Colorado.

DIRPHYS new genus.

Type: Mesidia mexicana How. Tech. Ser. No. 12, pt. IV, Bureau of Ent., U. S. Dept. of Agr., p. 74, 1907.

Female: Antennæ eight-jointed, markedly clavate, club distinctly three-jointed; the three funicle joints about equal in length, but increasing in width from one to three. Eyes hairy. Mesoscutellum transverse, broader than long. Fore-wings broad, with a broad distinct oblique hairless line; submarginal vein unusually broad, stigmal very short and without knob. Hind femora somewhat swollen. Abdomen triangular in shape seen from above, ovipositor well exserted.

It should be explained that the figure accompanying the original description of *D.* (*Mesidia*) *mexicana*, the artist, working without supervision, being confused by the presence on the same slide of fragments of what appears to be a *Coccophagus*, the antennæ in particular are entirely erroneous. The description of the antennæ is also obviously that of the other insect. In the true *Dirphys mexicana* the antennæ are pallid with the club faintly yellowish.

GENUS PARAPHELINUS Perkins.

Paraphelinus Perkins. Bull. 1, part 6, Report of Work of the Experiment Station of the Hawaiian Sugar Planters Assoc., Honolulu, January, 1906, p. 264.

Type: *P. xiphidii* Perk. Loc. cit.

Perkins's *P. xiphidii* was reared from the eggs of *Xiphidium varipenne* Swezey. The only other species so far discovered, viz.: *P. speciosissimus* Girault (Journ. N. Y. Ent. Soc., 1911, p. 181) and *P. australiensis* Girault (Archiv für Naturgeschichte, 1913, pp. 74–75, Ab. A. 6 heft), were both described from single captured specimens, so that their host relations are unknown. The receipt of the new species here described from Mr. P. L. Guppy of Trinidad, who reared it from the eggs of the sugar cane leaf-hopper, *Tomaspis varia*, makes it probable that all species of this interesting genus are parasites in the eggs of Orthoptera and Homoptera that are inserted in twigs or canes. This would be an unique feature in Aphelinine biology (the other forms all ovipositing only in Coccidæ, Aphididæ and Aleyrodidæ) were it not for the old disputed species *Agonioneurus locustarum* Giraud (placed in *Aphelinus* by Dalla Torre) and which was described by Dr. J. Giraud in his Memoir on the insects which live upon the common rose (Verh. d. Zool.-Bot. ges. Wien., vol. 18, 1863, pp. 1278–1279) and which he reared from the eggs of *Xiphidium fuscum* F. It seems to me quite possible that in the old *A. locustarum* we may have another species of *Paraphelinus*. There is

nothing in the original description which would seriously deny this guess, except the absence of the hairless discal streak on the primaries, and this is obscure in the species about to be described.

Paraphelinus tomaspidis n. sp.

Female: Length 0.57 mm.; expanse 1.15 mm.; greatest width of fore-wing 0.153 mm. General color dull honey-yellow, legs and antennæ pallid. Pedicel longer than third funicle joint; first and second funicle joints together equaling length of third, and both set somewhat obliquely when seen from side; club longer than the three funicle joints and slightly hooked at tip, as indicated in Perkins's figure of the antenna of *P. xiphidii*. Wings hyaline; oblique hairless streak below stigma indistinct and incomplete. Ovipositor well exserted.

Male: Unknown.

Described from two female specimens reared from eggs of *Tomaspis varia* by P. L. Guppy, Trinidad.

Type: No. 18321, U. S. N. M.

Mr. Guppy writes that only three specimens were reared, and that the species is extremely active, "running backwards and forwards all the time."

Genus Physcus Howard.

TABLE OF SPECIES.

1. Mesoscutellum much longer than wide .... *gracilis* n. sp.
   Mesoscutellum at least as wide as long 2
2. Antennal club concolorous with two preceding sclerites.. *stanfordi* n. sp.
   Club dark brown, preceding sclerites yellow or white 3
3. Mesoscutum with minute punctures .... *testaceus* Masi
   Mesoscutum longitudinally shagreened 4
4. Light yellow in color with cross banded abdomen .... *flavidus* Zehnt.
   Thorax dark brown, abdomen yellow with brown sides.. *flaviventris* How.
   Dark in general color 5
5. Scutellum with 2 light round spots surrounded with a rosette of shagreenings .... *fijiensis* n. sp.
   Such spots not evident 6
6. Marginal vein distinctly yellow .... *townsendi* n. sp.
   Marginal vein slightly dusky, not yellow .... *varicornis* How.

Genus Physcus Howard.

Physcus Howard. Tech. Ser. 1, U. S. Dept. Agr., Div. of Ent., 1895, p. 43.
Type: *Physcus varicornis* (How.), *Coccophagus varicornis* How. Ann. Rept. Dept. Agr., 1880, p. 360.

Physcus fijiensis n. sp.

Female: Length 1.1 mm.; expanse 2.17 mm.; greatest width of fore-wing 0.374 mm. Body rather stout, two and one-half times longer than broad; head nearly half as long as thorax, abdomen slightly longer than thorax, wings reaching well behind tip of abdomen, and about as broad as thorax. Mesoscutellum about as long as broad, well rounded caudad and roundly constricted cephalad. Mesoscutum and scutellum strongly longitudinally shagreened, scutellum with two round spots from each of which the shagreen cells radiate like a rosette. Stigmal vein slender with only a slight knob. General color dark brown, metanotum and center of abdomen dark yellowish, funicle joints two and three of the antennæ white, tip of club whitish, remainder of antennæ nearly black; middle legs yellowish, hind legs light yellowish; front femora and tibiæ brown. Wings hyaline.

Described from seven female specimens reared by Albert Koebele, October 24, 1899, Sava, Fiji, from an *Aspidiotus* on a semi-climbing rutaceous vine.

Type: No. 18317, U. S. N. M.

This species will probably, in large series, be found to vary in thoracic coloration since in two of the specimens the mesoscutellum has a central longitudinal yellowish stripe, while the mesoscutum has two such stripes parallel the one to the other.

Physcus gracilis n. sp.

Female: Length 0.918 mm.; expanse 1.97 mm.; greatest width of fore-wing 0.289 mm. Body slender, thorax more than twice as long as broad; mesoscutellum elongate, longer than broad, scapula impinging on a straight line; fore-wings long, extending when closed very considerably beyond the tip of the abdomen, the stigmal vein just about reaching the abdomen tip. Mesoscutum very faintly longitudinally shagreened; stigmal vein very slightly enlarged at tip. General color reddish yellow, lighter at tip of abdomen and deeper and darker at front border of mesoscutum; legs concolorous with body; scape, pedicel and funicle joints 2 and 3 of the antennæ white, first funicle joint and club dark brown.

Described from seven females from Perth, West Australia, Geo. Compere (Compere's No. 981) and one from Swan River, West Australia (Compere's No. 810). Apparently reared from a Lepidosaphes.

Type: No. 18318, U. S. N. M.

Physcus townsendi n. sp.

Female: Length 0.986 mm.; expanse 2.07 mm.; greatest width of fore-wing 0.374 mm. A stout-bodied form with ovipositor well extruded. Mesoscutellum wider than long, sharply angled against scapulæ and scutum. Mesonotum faintly longitudinally shagreened. Stigmal club larger than

with preceding species, no trace of a postmarginal. General color dark brown, nearly black, opaque; hind coxae whitish; all femora and tibiæ dark brown, light at extremities, except middle tibiæ of which the apical half is yellowish; all tarsi yellowish except the brown terminal segments. Wings hyaline, marginal vein distinctly yellow; antennæ white with first funicle joint and club black.

Described from one female, reared by C. H. T. Townsend at Lima, Peru (Townsend's No. 1145 degree 3a), December 31, 1909.
Type: No. 18319, U. S. N. M.

Physcus stanfordi n. sp.

Female: Length 1.1 mm.; expanse 2.07 mm.; greatest width of fore-wing 0.289 mm. A rather slender, elongate form with mesoscutellum rather longer than broad and with the line of impingement of scapulæ on scutellum rounded at anal angle. Mesoscutum and mesoscutellum faintly longitudinally reticulate. General color brown, the abdomen cross-banded with darker brown. Antennal scape brown, pedicel brown above at base, light yellow below; funicle joint one brown, remainder of flagellum, including club somewhat dusky (no contrast between segments two and three and the club such as occurs with other species). Legs colored as with preceding species. Wings hyaline, veins slightly dusky, stigmal vein very slightly enlarged at tip.

Described from one female specimen reared March 22, 1902, by G. A. Coleman of Stanford University from his *Leucaspis kelloggi*.
Type: No. 18320, U. S. N. M.

Genus Azotus Howard.

Azotus Howard. Proc. Ent. Soc. Washington, iv, 2, 1898, p. 138.
Type: *A. marchali* How., loc. cit., p. 139.

Since I described the genus *Azotus* in the Proceedings of this Society in 1898, four species in addition to the type have been found and described, viz.: *A. capensis* How., *A. pinifoliæ* Mercet, *A. pulchriceps* Zehntner, and *A. speciosissimus* Gir. All have been reared from Coccidæ except the last which was captured. The recorded distribution of the genus is France, Spain, Australia, Java, South Africa and Japan. It is probably of oriental origin and imported into Europe. Specimens of *A. marchali* have been reared in the Bureau of Entomology by Mr. J. F. Zimmer from *Aspidiotus uvæ* Comst. collected in the District of Columbia, so that this species has probably become widely spread.

In a lot of reared parasites received a few years ago from Mr. S. I. Kuwana, of Tokio, the following new species was found.

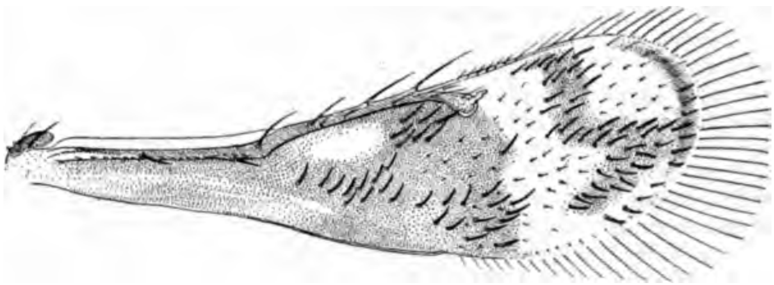


Fig. 1. *Azotus chionaspidis*, right fore-wing, greatly enlarged.

Azotus chionaspidis n. sp.

Female: Length, exclusive of ovipositor, 0.61 mm.; expanse 1.19 mm.; greatest width of fore-wing 0.136 mm. General color dull light brown; mesoscutum and scutellum lustrous metallic green, shagreened; head from above lighter than rest of body; eyes bright red; funicle joints two and four silvery white, rest of antennæ dark brown; all legs brown, lighter at knees, middle tibiæ lighter towards tip, tarsi white with terminal joint dusky. Fore-wings irregularly infuscated as in accompanying figure which also shows the distribution of bristles and discal cilia; hind-wings slightly infuscated for basal half.

Male: Unknown.

Described from a single female reared by Prof. S. I. Kuwana, Tokio, Japan, August 17, 1909, from *Chionaspis difficilis*.

Type: No. 18323, U. S. N. M.

NEW PARASITIC HYMENOPTERA FROM BRITISH GUIANA.

By J. C. Crawford, *U. S. National Museum.*

(Telenomus) Prophanurus minutissimus Ashmead.

A large series of this species was bred from the eggs of *Lycophotia infecta*, in British Guiana, by Mr. G. E. Bodkin. When the species was originally described the host was given as *Dactylopius* species; this record is very probably erroneous as the species of this group, so far as they have been bred, are egg parasites.

Prophanurus alecto n. sp.

Female: Length about 0.7 mm. Black, with flattened form, the vertex horizontal, posterior orbits broad, not carinate; antennæ reddish-testaceous, the pedicel about as long as the first two joints of the funicle combined,

the first three joints of funicle subquadrate, the fourth transverse, the club five jointed; mesoscutum rather coarsely and closely punctured; scutellum similarly punctured but the disk smooth and polished; legs brown with the bases and apices of femora and tibiæ, and the tarsi entirely, lighter; first abdominal segment striate at base, second with a basal row of pits and beyond this a few short striæ medially.

Male: Length about 0.7 mm. Similar to the female; the antennæ flavous, pedicel longer than first joint of funicle; the first three joints of funicle almost subequal in length, slightly longer than broad; the following joints transverse, the last conical; legs, except coxæ, flavous, the femora slightly infuscated; striæ on second abdominal segment beyond the basal pits, longer and more numerous than in female.

Type-locality: Plantation La Bonne Intention, British Guiana. Other locality: Plantation Oitvlugt, British Guiana.

Host: Eggs of *Diatræa saccharalis.*

The series from the type locality contains six females and one male with the date February 2, 1913; from the other locality one female and eight males, with the date January 31, 1913, all collected by Mr. G. E. Bodkin.

Type: Cat. No. 18170, U. S. N. M.

This species is near to (*Telenomus*) *Prophanurus impressus* Ashmead to which it runs in his table[1] but differs in the flattened head and the dark legs of the female, etc.

Prophanurus thais n. sp.

Female: Length about 0.9 mm. Black, the legs, except the dark front coxæ, testaceous; head transverse, the posterior orbits very narrow, carinate; face reticulated; scape testaceous, funicle light brown, becoming darker apically; club five-jointed, dark brown; pedicel and first joint of funicle subequal in length, following joints of funicle subquadrate; mesoscutum with coarse punctures, the extreme rear smooth, the scutellum smooth; first abdominal segment rugose almost to apex, second segment with basal row of pits but beyond them smooth.

Male: Length about 0.9 mm. Similar to the female, the antennæ testaceous shading into brown on apical half of funicle; pedicel about as long as third joint of funicle, distinctly shorter than the first, the first and second subequal; fourth joint of funicle longer than broad, the following joints subquadrate; the last twice as long as broad.

Type-locality: Georgetown, British Guiana. Described from 15 specimens bred July 7, 1912, from the eggs of a large pentatomid by Mr. G. E. Bodkin.

Type: Cat. No. 18171, U. S. N. M.

[1] Journ. Linn. Soc. Lond., 2, vol. xxv, 1894, pp. 201–203.

Aphanurus bodkini n. sp.

Female: Length 2 mm. Black, the face finely reticulated and with sparse large punctures; the antennal scrobes transversely rugose, the vertex carinate, the carina on each side extending down the posterior orbits; scape, pedicel, and first joint of funicle reddish honey-color, the rest of the antennæ dark brown, the club composed of six segments; first joint of funicle longer than the pedicel; second joint subquadrate, the third transverse; mesoscutum and scutellum irregularly rugose; the scutellum with a row of pits at apex; metanotum with a middle raised area extending over the propodeum and carinate at apex; this area with three or four longitudinal carinæ; the legs, except the black coxæ, entirely reddish honey-color; first abdominal segment with strong carinæ extending to apex, the second segment slightly wider than long, at base with a row of pits, beyond finely longitudinally rugose for about two-thirds its length.

Male: Length 1.75 mm. Similar to the female but the antennæ and legs more yellowish, third joint of antennæ twice as long as pedicel, strongly clavate, fourth and fifth joints also clavate, sixth and following joints distinctly narrower than the fifth and successively narrowing making the antennæ distinctly attenuate.

Described from eighteen females and two males from British Guiana, bred October 9, 1913, from the eggs of *Empicoris variolosus* by Mr. G. E. Bodkin.

Type: Cat. No. 18174, U. S. N. M.

Chalcis pandora n. sp.

Female: Length about 5 mm. Black, head and dorsum of thorax coarsely umbilicately punctured; carina at the front of the malar space running direct to the eye; scutellum with the apical edge rather strongly produced and flat, the plate covered by yellowish pubescence; tegulæ white; legs black; apical half front femora and front tibiæ, except a spot on middle of lower side, light yellowish; mid-femora at apex and the mid-tibiæ, except an elongated black stripe on lower side, light yellowish; hind femora with light yellowish spot at apex; hind tibiæ above with a light yellowish stripe narrowed medially; tarsi, except apices, light yellowish; lower margin of hind femora near base with a large tooth and between this and the apex about eight or nine small teeth; inner side of hind femora finely punctured, the lower margin near the middle with a distinct tubercle; hind coxæ on inner side below with a distinct tubercle near middle; first abdominal segment smooth, the following segments finely punctured and with sparse light yellowish hairs becoming more abundant toward apex of abdomen.

Male: Length about 4.5 mm. Similar to the female except for secondary sexual characters.

Described from six specimens from British Guiana, bred April 19, 1913, from larva of a hesperid by Mr. G. E. Bodkin.

Type: Cat. No. 18175, U. S. N. M.

Among the secondary sexual characters in this genus, are the tubercles on the hind-coxæ and on the lower inner margin of hind femora, so these characters mentioned for the female will not be found in the male.

Holcencyrtus calypso n. sp.

Female: Length about 0.87 mm. Face bronzy æneous, frons greenish; mesoscutum green, scutellum bronzy æneous with the apex green; abdomen æneous; face and frons reticulate, vertex sharply carinate behind; lateral ocelli about their own width from eye margin; face produced below, the malar space being almost as long as the eye; antennæ dark brown, clavate; funicular joints subquadrate, the pedicel as long as joints one and two of funicle combined; club about as long as the last three joints of funicle combined; mesoscutum and scutellum reticulate, the former more distinctly and coarsely so; scutellum with a distinct medial longitudinal depression at base; wings hyaline; legs brown, knees, tibiæ at apices and tarsi reddish-testaceous.

Described from many specimens from British Guiana, bred July 20, 1913, from the larvæ of *Calpodes ethlius* by Mr. G. E. Bodkin.

Type: Cat. No. 18172, U. S. N. M.

Elachertus meridionalis n. sp.

Female: Length 1.75 mm. Black, the head with green and purplish tints, the abdomen with a large whitish spot near base; frons finely lineolate and with a few scattered, large punctures; scape testaceous, pedicel light brown, rest of antennæ dark brown; first joint of funicle longer than pedicel; mesoscutum finely irregularly rugose, almost obscuring the parapsidal furrows; axillæ finely lineolate; scutellum finely longitudinally aciculate; metanotum long, smooth; propodeum about twice as long as the metanotum, with a strong median carina; legs whitish, the coxæ almost entirely brown, the hind femora and hind tibiæ with about the apical half brown.

Male: Length 1.5 mm. Similar to the female but with less intense brown on the hind femora and tibiæ.

Described from eighteen specimens from British Guiana, reared August 20, 1913, from the larvæ of *Calpodes ethlius* by G. A. Bodkin.

Type: Cat. No. 18173, U. S. N. M.

DESCRIPTION OF A NEW SPECIES OF AGROMYZA FROM PORTO RICO.

By J. R. Malloch.

Agromyza inæqualis n. sp.

Male: Black. Frons opaque, brown-black on center stripe, shining black on frontal triangle and orbits, the former subtriangular and not reaching to middle of frons; viewed from the side the frontal stripe shows slight signs of whitish pollen; the frontal lunule is distinctly white pollinose as seen from above; antennæ black, arista concolorous; proboscis yellowish at apex, palpi black; cheeks black; mesonotum rather glossy black, with a slight bluish tinge; pleuræ and scutellum concolorous, the former very slightly whitish pollinose. Abdomen glossy black, with a very decided blue-green luster. Legs wholly black. Squamæ whitish yellow, fringe concolorous. Wings clear, veins black. Halteres whitish yellow, the stalk yellow.

Fig. 1. *Agromyza inæqualis* n. sp.

Frons slightly over one-third the width of head, very slightly converging anteriorily; orbits distinct, each slightly less than half as wide as frontal stripe; four pairs of orbital bristles present, the upper one in almost transverse line with the anterior angle of frontal triangle, very weak, the second about twice as long and very strong, the third much weaker, but still stronger than the upper, and the anterior pair of about the same strength as the upper, or posterior, pair; a few weak, scattered hairs present on orbits between the bristles and the eye margin; vertical bristles strong; antennæ moderate in size, situated about middle of head in profile, third joint rounded, the pubescence very short; arista thickened at base, tapering, its length equal to from its base to the upper orbital bristle, pubescence very indistinct; cheek very short and narrow, less than one-sixth the height of eye and almost as high as long; marginal bristles distinct but not numer-

ous; vibrissa well differentiated; face in profile slightly retreating, mouth margin not produced; mesonotum with two pairs of strong dorso-centrals, the anterior pair placed far forward, generally about three-fourths of the distance to the suture; sometimes there is a setula anterior to this bristle but it cannot be considered as a dorso-central; the pair of bristles between the posterior dorso-centrals is distinct but rather weak; discal hairs weak, but numerous, about ten to twelve rows between the dorso-centrals. Abdomen ovate, tapering towards apex; surface hairs numerous but not bristle-like; hypopygium small; legs rather stout; mid-tibia with the posterior bristles well developed and rather closely placed, the upper one distinctly the longest. Wings as figure. Length 2 to 2.5 mm.

Female: Similar to the male in all particulars except the ovipositor which is rather short and of the normal form, not projecting further than the length of last abdominal segment.

Type-locality: Rio Piedras, Porto Rico, December 2, 1913 (T. H. Jones), Porto Rico Sugar Growers' Association, Accession No. 983, 1913. Three males and one female. Reared from *Vigna repens* (?).

Type: Male, deposited in U. S. National Museum, Washington, D. C. This species will run down to *viridula* Coq. in the synoptic table of this genus in my recent paper in the Annals of the Entomological Society of America, but the very marked difference in the size of the orbital bristles should readily separate it from that species, and also from *dubitata* Malloch, which it also resembles very closely. In general appearance this species resembles closely the species belonging to the *virens* group, but the pale halteres may be readily used as a means for separation.

FOUR NEW SPECIES OF TACHINIDÆ FROM NORTH AMERICA.

By W. R. Walton, *Bureau of Entomology.*

Polychætoneura new genus.

Body with true macrochætæ, palpi normal, proboscis short fleshy, first, third and fifth veins all bearing closely set black setulæ for at least two-thirds their lengths. Ocellar bristles present normal, facial ridges bristly on lowest fifth only. Arista pubescent, second joint slightly longer than broad. Apical cell entering costa at extreme tip of wing, fourth vein rounded in a circle of large radius, posterior cross vein straight, approximating 90 degrees of angle, entering fourth vein midway to bend. Costal spine small. Head much shorter at vibrissæ than at base of antennæ. Face on lower half of sides, bare. Third antennal joint broad, rounded at apex. Eyes of female bare. Abdomen ovate, legs short.

Type: Polychætoneura elyii n. sp.

Polychaetoneura elyii n. sp.

Length 3 to 4 mm. Female, yellow, thorax gray pollinose. Front slightly wider than eye, yellow, parafrontals yellow, whitish pollinose. Frontal vitta yellow, opaque, nearly twice as wide as either parafrontal. Face yellowish white fading into white on cheeks and epistoma, facial depression very broad, sides of face narrow not more than one-eighth as wide as depression. Vibrissæ black situated slightly below front edge of oral margin. Palpi and proboscis whitish. Antennæ large, reaching almost to oral margin, first, second and base of third joints pure yellow, apical two-thirds of latter darker verging on brown. Arista incrassated on basal third which part is yellow, remainder black. Arista pubescent, almost to, but not reaching tip, hairs nearly as long as greatest diameter of style. Cheeks whitish bearing a few short bristles on front portion of disc and two or three forwardly curving macrochætæ on their lower margins.

Two pairs of orbitals, frontals descending to lower edge of first antennal joint. Entire occiput whitish thinly clothed with whitish bristles and hairs. Thorax including scutellum, entirely opaque gray pollinose, only the merest suggestion of vittæ on the anterior portion when viewed from behind. Post sutural bristles four, sterno pleurals two with sometimes a large bristle-like hair or two below them towards the middle of sterno pleural plate. Abdomen ovate yellow, slightly darker toward apex. First segment destitute of true macrochætæ, second, third and fourth, bearing marginals, the latter two with a row of six or more. Genitalia concealed, venter yellow. Legs including coxæ yellow, middle tibiæ on front side slightly beyond middle with a single strong macrochæta. Hind tibiæ not ciliate. Wings rather short and broad, veins mostly yellow, apical cell open in tip of wing in female.

Described from three females reared from *Schizura concinna* at East River, Connecticut, August 2, 1912, by Mr. C. R. Ely, in honor of whom the species is named. This insect is remarkable chiefly because of its having the fifth vein of the wings bearing setulæ, a character unique among the Tachinids of this country so far as I am aware.

Dionea timberlakei n. sp.

Female: Rather slender, black and orange yellow. Wings slightly infuscated along costal margin. Length 5 to 7 mm. Female, frontal vitta opaque velvety black, bordered on each side with bands of shining black which occupy full width of parafrontals at vertex, but taper to a point at base of antennæ, area outside of these also lower half of front and fascialia silvery pollinose. Antennæ opaque black, about two-thirds length of face, third joint about twice length of second gently rounded at apex. Arista

incrassated on basal third. Two pairs of orbitals present. Cheeks black, thinly grayish pollinose not wider than one-sixth eye height, transverse impression silvery. Inferior occiput swollen, superior linear, silvery, head wider at vibrissæ than at base of antennæ. Palpi yellowish. Intermediate third of proboscis cylindrical, black, chitinized, apical third fleshy, yellowish, entire length slightly greater than height of head.

Thorax shining black, marked with three short, silvery, pollinose vittæ one over each humerus and one median in a similar manner to *Morelia micans*. Scutellum triangular, shining black, bearing three pairs of marginals and a strongly cruciate apical pair. Dorso-central bristles three, sternopleurals two. Abdomen slender, shining, absolutely bare of pollen, five segments visible, the first quite short and black. Second and third segments orange yellow, bearing a median black vitta which does not reach the anterior or posterior margins in the latter. Fourth segment somewhat wrinkled transversely, dark yellow, marked with a broad black median vitta extending to the lateral margins at the apex of segment. Fifth segments (figs. 3-4) shining black, wrinkled, with a triangular depression in the center upon the margins of which are borne some short black spines, apex provided with the usual stout forceps as shown in the figures.

Segments two to four inclusive, bearing stout median and lateral marginals. No discals present on any segment. Legs rather long and stout, middle tibiæ bearing three strong macrochætæ on front side near middle. Posterior bearing two outside and two inside near middle, apical tibial spurs unusually long and stout.

Wings narrow, slightly infuscated along costal margin. Costal spine present but small. Veins yellowish at base, black at apex. Bend of fourth vein very slightly angulated, apical cell barely open in margin. Hind cross vein enters fourth vein much nearer to bend than to small cross vein. Angle with fifth vein about 115 degrees. Calypters whitish.

Male: Differs from female as follows: larger, strongly resembles male of *Leucostoma*. Orbital bristles absent, head (fig. 5) wider than thorax and large in proportion to body. Front very narrow, bare excepting a single row of frontals. Third antennal joint about one and one-half times longer than second. Palpi slender nearly black. Abdomen more ovate, black, longitudinal median bands of second and third segments broader and continuous. Fourth segment sometimes almost entirely black, showing a mere line of yellow on lateral margins. Ordinary vestiture of the abdomen longer and more erect than in female. Venter yellow with a narrow black median vitta. Hypopygium barely visible, black. The bend of the fourth vein is subject to considerable variation in this species, in some specimens it is gently rounded, others have it slightly angulated, one of the latter, a male, bears a distinct short stump at the bend.

Described from seven specimens, male and female, collected at Salt Lake, Utah, May 15 to 21, by P. H. Timberlake of the Bureau of Entomology and in honor of whom this species is named. Two

males standing in U. S. Museum collection under *Leucostoma* undetermined specifically, bearing label Cache County, Utah, J. M. Aldrich. Species belonging to this genus are said to be parasitic on beetles of the genus *Cassida* in Europe.

Linnæmyia fulvicauda n. sp.

Resembles *hæmorroidalis* Fall. but differs as follows: Cheeks black, palpi black, not flattened transversely when viewed from front. Fourth segment of abdomen pure orange yellow, front and superior occiput usually golden pollinose. Third antennal joint rounded at apex. Length 8 to 9 mm. Female, frontal vitta dark brown to blackish, sides of front thinly sprinkled with black hairs, and covered with golden pollen which extends downwards on parafacials around border of eyes and also to superior occiput; remainder of face whitish pollinose excepting facial ridges which are bordered on inner side with blackish. Antennæ brown, basal joints black. Third joint (fig. 6a) about twice length of second, straight or slightly concave on anterior border; apex broadly rounded. Arista rather slender, black, second joint about as long as broad. Eyes rather densely hairy. Cheeks distinctly black, clothed with bristly hairs. Palpi black, linear. Proboscis about as long as head height, blackish, chitinized on intermediate third.

Thorax gray, marked with four distinct black vittæ. Scutellum rounded, black, a faint yellowish tinge at apex. Dorso-centrals three, sternopleurals three. Abdomen ovate, three basal segments black pseudomaculate with gray. Second and third bearing discals and marginals. Fourth, dorsally, pure orange yellow slightly yellow pollinose. Genitalia retracted, yellow. Wings slightly grayish. Veins yellowish. Third vein bristly half way to small cross vein. Bend of fourth appendiculate; apical cell open in costa. Legs black including coxæ, hind tibiæ not ciliate, middle tibiæ bearing from two to five strong macrochætæ on front side. Angle of hind crossvein 115 degrees in four specimens, enters fourth vein close to bend.

Male differs as follows: Third antennal joint distinctly convex on front border (fig. 6), nearly two and one-half times length of second. Yellow pollen of front does not usually extend to parafacials. Eyes more densely hairy. Palpi brownish. Hypopygium exerted, doubled forward, entirely yellow. Apical cell more narrowly open in costa. Front in both sexes of about same width, i.e., three-fourths that of eye.

Described from five specimens, male and female, reared from *Remigia repanda* Fabr., by T. H. Jones from specimens taken at Aibonito and Rio Piedras, Porto Rico. Issued February 3 to 23, 1912. Type a female.

Compsilura oppugnator n. sp.

Female: Black and gray, wings hyaline. Length 7 mm. Front about two-thirds as wide as eye, vitta dark brown, parafrontals golden yellow

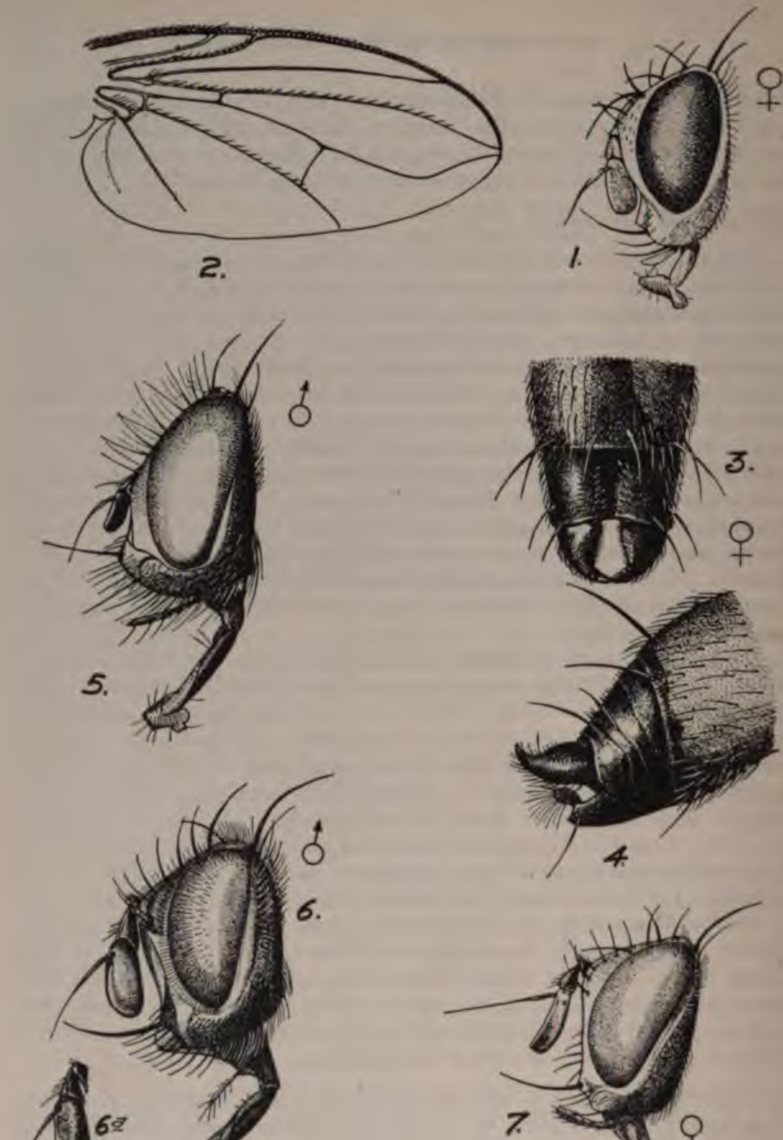


Fig. 1. *Azotus chionaspidis.* Right fore-wing greatly enlarged.
Polychætoneura elyii: 1, lateral view of head; *2,* wing of same.
Dionea timberlakei: 3, female, dorsal view of apical abdominal segments; *4,* same lateral view; *5,* head of male, lateral view.
Linnæmyia fulvicauda: 6, male, lateral view of head; *6a,* antennæ of female.

pollinose. Two pairs of orbital bristles present, frontals descending to apex of second antennal joint (fig. 7). Face including cheeks gray pollinose, parafacials not more than one-sixth as wide as facial depression; fascialia bristly on nearly the lower half. Vibrissæ on oral margin not strongly cruciate. Proboscis brown, short and fleshy, palpi dark yellow. Cheeks about one-sixth height of eye. Ocellar bristles absent, eyes in the type nearly bare. Posterior orbits yellowish, occiput gray, rather thinly clothed with whitish hairs. Thorax gray pollinose, four distinct black vittæ visible extending nearly to scutellum where each outer pair is approximated but not joined. Scutellum triangular, gray pollinose, bearing three marginal pairs, also a discal pair; apicals absent. Dorso-central bristles three, sternopleurals three. Abdomen elongate ovate, black, intermediate segments broadly gray pollinose on basal two-thirds extending almost to posterior margins at center and on the extreme sides of segment. A narrow median vitta apparent on intermediate segments. Fourth segment black and grayish pollinose at base, yellow on apical third, anal plate yellow. First and second segments destitute of true median marginal or discal macrochætæ, third bearing a median marginal pair but without discals, fourth with both discals and the usual row of stout marginals.

The two intermediate segments each bearing on its ventral surface a median keel armed with backward curving short stout spines precisely as in *concinnata;* apical segment armed with a curved chitinized piercer. Legs black, middle tibiæ bearing a single stout macrochæta on the front side near the middle, hind tibiæ subciliate.

Wings hyaline, first posterior cell narrowly open in margin, distinctly before tip of wing; fourth vein shortly rounded at bend; costal spine obsolete. Calypters whitish nearly transparent, edges yellowish.

Described from a single female reared from *Cirphis latiuscula* H. S., at Rio Piedras, Porto Rico, January 30, 1912, by Mr. T. H. Jones.

The species described above resembles *Compsilura concinnata* rather strongly, the chief differences are as follows: Front and posterior orbits yellow pollinose; eyes nearly bare; apical pair of scutellar bristles absent; discal macrochætæ of intermediate abdominal segments absent; cheeks not more than one-sixth eye height; tip of fourth abdominal segment and anal plate yellow. The genus *Compsilura* has hitherto not been reported from this country, except of course as artificially introduced into the New England States, and some of the characters above enumerated are by a few authors regarded as of generic value. But as the proposed species is based upon a single reared female specimen, the habitus and main structural characters of which agree exactly with *Compsilura,* I think that it would better be referred here, at least until such time as the male becomes known.

THE EGG OF PSEUDOSERMYLE TRUNCATA CAUDELL.

By A. N. Caudell, *Bureau of Entomology.*

Messrs. Schwarz and Barber brought from Sabino Canyon, Arizona, a female of the above species which was taken by Mr. F. I. Tucker. It was inclosed in a glass jar and before dying it deposited several eggs, one of which is here figured. This egg is of considerable interest, not so much for the odd shape, for extraordinary shapes are common in this family of Orthoptera, but for the fact that they are not dropped at random by the insect but fastened to some object. In nature, they are very securely glued to the stems and branches of the food plant. The common supposition has been that the eggs of Phasmids were

Fig. 1. Egg of *Pseudosermyle truncata*, greatly enlarged.

dropped free but just how far this is true is not at all certain. The eggs of a goodly number of species have been described but the habits of oviposition are but little recorded. Brunner and Redtenbacher in their recent monograph of the family make no mention of exceptions to the rule of free dropping of eggs, nor does Sharp in the Cambridge Natural History. In fact, the only mention I know of the fastening of the eggs of walking sticks is by Shelford in Rept. Brit. Assoc. Adv. Sci., 1901, p. 689–691, where it is stated that in Borneo the Phasmidae of the genera *Necroscia*, *Marmessoidea* and *Agondasoidea* stick the eggs in rows on the leaves of the food plant, not dropped at random as in others.

Actual date of publication, June 12, 1914.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVI | 1914 | No. 3

Two Hundred and Seventy-Fifth Meeting, March 5, 1914.

The following program was presented:

Variations in Insects and their Transmission...............Nathan Banks[1]
Method of Fumigating Imported Seed
E. R. Sasscer and Dr. Lon A. Hawkins[2]
A new species of *Callichroma* from Texas.....................W. S. Fisher
A Revision of the North American Species of the Braconid genus *Habrobracon*..R. A. Cushman
Secondary and Tertiary Sexual Characters in Muscoid Flies and their Classificatory Value........................ Charles H. T. Townsend

At the conclusion of the program Mr. C. P. Alexander of Cornell University addressed the Society on his studies of the family Tipulidæ, and Mr. M. D. Mitzmain gave an account of his recent work in the Philippine Islands on the insect transmission of surra in stock animals.

A NEW SPECIES OF CALLICHROMA FROM TEXAS.

By W. S. Fisher, *Bureau of Entomology.*

Callichroma schwarzi n. sp.

Male: Rather dull in lustre and of a greenish-blue color throughout above, same beneath but more shining; abdomen rufo-ferruginous; antennæ, all of the femora, tibiæ and tarsi black. Prothorax as in *C. plicatum* Lec., with front deeply constricted, two elevated spaces just back of the constriction and one long transverse elevated ridge on the poste-

[1] Withdrawn by author.
[2] Withdrawn for publication elsewhere.
[3] To be published later.

rior area; with unequally transverse rugæ; densely and finely punctate, with short inconspicuous black hairs. Prosternum concave and transversely plicate. Antennæ twice the length of the body. Elytra strongly tapering from base to apex, tips separately rounded, sides slightly arcuate; clothed with short inconspicuous ashy grey pubescence; densely and finely punctate except small space at base close to the suture with coarser punctures. Under surface covered with ashy grey pubescence. Scutellum triangular, longer than wide, grooved down the middle, irregularly coarsely punctate. Femora of front and middle pair of legs short and thickened, posterior femora long, reaching a little beyond the tips of the elytra, slightly thickened externally. Posterior tibiæ nearly as long as the femora, arcuate and flattened. Notch of the fifth ventral segment parabolic. Length 35 mm.; width at base of elytra 9 mm.

Female: Differs from the male in being smaller, antennæ not reaching the tips of the elytra, prothorax similar to that of *C. splendidum* Lec., not transversely rugose at center but densely finely punctured, and slightly rugose toward the sides. Elytra with two inconspicuous transverse bands of a violet shade, one just in front and the other just back of the middle. Posterior femora slightly arcuate. Posterior tibiæ nearly straight. Length 28 mm.; width, 7 mm.

Habitat: McAllen, Texas.

Type and *allotype* Cat. No. 18237 U. S. N. M. Paratypes in the author's collection.

Described from four specimens, two females and two males, received from D. K. McMillan with the following note, "Collected May 22, 1909, on the blossoms of *Cissus incisa*, rather common and a number of mating pairs were crawling among the foliage."

This species is allied to *C. plicatum* Lec. but is distinguished from that and the other species found in the United States by having dull greenish-blue elytra and all of the femora black. Named for E. A. Schwarz.

The following table will assist in the identification of the species found north of Mexico.

All of the femora testaceous tipped with black.......................... 1
All of the femora entirely black.. 2
Front and middle femora black, the posterior ferruginous tipped with
black, elytra blue....................................... *cobaltinum* **Lec.**
1. Thorax and elytra varying from blue to green, thorax with a coppery hue... *splendidum* **Lec.**
Thorax and elytra bright green, without coppery hue. Male with fifth ventral deeply broadly emarginate.............. *smaragdinum* **Casey**
Male with fifth ventral parabolic, not emarginate....... *plicatum* **Lec.**
2. Elytra velvety black............................ *melancholicum* **Bates**

A REVISION OF THE NORTH AMERICAN SPECIES OF THE BRACONID GENUS HABROBRACON JOHNSON (ASHMEAD).

By R. A. Cushman, *Bureau of Entomology.*

The name *Habrobracon* was given by Ashmead in his Classification of the Ichneumon Flies (1900) to include those members of the genus *Bracon* in which the second abscissa of the radius is "not, or scarcely, longer than the first, usually a little shorter than the first transverse cubitus, or no longer." Previous to this date, however, W. G. Johnson published a note (Ent. News, 1895, VI, p. 324–5) in which he used the name in connection with the species *hebetor* Say and *gelechiæ* Ashmead. Ashmead (loc. cit., p. 173) gives as the first publication of the name the above note by Johnson. This makes it necessary to credit the genus to Johnson. Viereck (Bull. 83, U. S. Nat. Mus., 1914, p. 65) credits the genus to Ashmead and fixes *Bracon gelechiæ* Ashmead as the type.

The following description of the genus is gleaned from Ashmead's table of the tribe Braconini:

Second abscissa of radius not, or scarcely, longer than the first, usually shorter than the first transverse cubitus, or no longer. First discoidal cell petiolate; head, thorax, and abdomen most frequently coriaceous or shagreened, rarely smooth and shining; antennal characters as in *Bracon* (*sensu stricti*); ovipositor short, rarely two-thirds the length of the abdomen, most frequently much shorter; last joint of hind tarsi about the length of the third, shorter than the second.

To the above may be added the following: Eyes more or less completely surrounded by a yellow or testaceous ring which sometimes extends inward so as to embrace more or less of the face and of the vertex; mandibles pale with black tips; first tergite with two furrows which converge anteriorly and set off a nearly equilateral, triangular, median area; second tergite subequal in length with the first, longer than the third, sculptured usually more coarsely than, and frequently differently from, those following.

The species of this genus show marked variations, not only in intensity and arrangement of color, but in such structural characters as the number of antennal joints, wing venation, sculpture and proportionate lengths of the tergites, relative length of ovipositor and abdomen, and even in the shape of the first tergite. A misunderstanding of the range of these variations, through lack of sufficient material for study, has led to the description of a number of species separated from others by the use of one or more of these variable characters.

The following table will separate the seven North American species referred to the genus. In the examination of the speci-

mens a Zeiss binocular with objective a_3 and eyepiece 4, giving a magnification of 61 diameters, was used. This high magnification is necessary for the observation of the minute sculptural characters used.

HABROBRACON JOHNSON (Ashmead).

TABLE OF SPECIES.

Antennæ stout and tapering toward the tip, flagellar joints beyond the second but little longer than wide; ocellar spot nearly or quite separated from the occipital spot by inward extensions of the yellow orbital ring behind the ocelli; face largely or wholly yellowish................ 1

Antennæ slender not tapering toward the tip, flagellar joints much longer than wide; ocellar spot and occipital spot broadly confluent... 2

1. Body smooth or but very faintly sculptured throughout; antennæ in female 13 to 15-jointed (17-jointed, according to Wesmael), in male 20 to 22-jointed (20 to 26, according to Wesmael); ocellar spot almost invariably entirely separated from occipital spot. *brevicornis* (Wesm.) (= *hebetor* auct. not Say = *juglandis* Ashm.)

   Body distinctly sculptured; antennæ in female 20 to 22-jointed, in male 23 to 25-jointed; ocellar spot except in very pale specimens not entirely separated from occipital spot............*variabilis* n. sp.

2. Second tergite with a median embossed area set off at least anteriorly by crenulate grooves, its surface differently sculptured from the rest of the tergite (in the male this character is less evident, the area being more narrow and the grooves less distinct); rest of tergite more or less finely, irregularly, longitudinally or reticulately rugulose.. 3

   Second tergite without an embossed area, granularly roughened, without rugæ though sometimes with very fine reticulation on the basal middle.. 5

3. Furrows of first tergite narrow and not crenulate, the triangle without large punctures apically, lateral areas shagreened; second tergite reticulate......................................*platynotæ* n. sp.

   Furrows of first tergite broad and crenulate, the triangle with a few large punctures apically, lateral areas much roughened; second tergite longitudinally rugulose.................................. 4

4. Mesoscutum with a large quadrate testaceous spot in front of the scutellum from which lines of the same color extend forward along the positions of the notauli; face in female with broad inward extensions of the yellow orbital rings below the antennæ; antennæ testaceous, infuscated beyond the middle, 23 to 24-jointed, in male (lost, but from the description evidently a poorly developed specimen) 21-jointed; abdomen in female yellowish, darker laterally *xanthonotus* (Ashm.)

Mesoscutum entirely black or with the color pattern reduced to lines indicating positions of notauli; face in female with the yellow reduced to a small spot beneath each antennal fossa, separated from the orbital ring by a brownish stain; antennæ black or occasionally somewhat testaceous, with 24 or more joints in female and 25 or more in male; abdomen in female with same color pattern as in *xanthonotus* but darker throughout, in male with the second tergite pale and the remaining tergites dark............*hopkinsi* Vier. (= *mali* Vier.)

5. Abdomen in female much wider than half its length, wider than the thorax, sixth and seventh tergites barely visible from above; female black, male with abdomen, especially second and third tergites, broadly margined with yellow, dark medially *gelechiæ* Ashm. (=*notaticeps* Ashm.)

Abdomen in female not much wider than half its length, not wider than the thorax; tergites 6 and 7 distinctly visible from above; sexes similarly colored....................*johanseni* Vier. (= *tetralophæ* Vier.)

Habrobracon brevicornis (Wesmael).

Bracon brevicornis Wesmael, Nouv. Mem. AS.SC. Bruxelles, XI, 1838, p. 23, fig. 2 (wing).

Brischke, Schr. Naturf. Ges. Danzig, (2) IV, 1882, p. 135. Host.—*Dioryctria abietella.*

Kirby, Trans. Ent. Soc. Lond., 1884, Proc., p. xxxi. Host.—*Ephestia elutella.*

Marshall, Trans. Ent. Soc. Lond., 1885, p. 24, Pl. I, figs. 1a (wing) and 1b (head and thorax). Redescription. Hosts.—*Myelois ceratoniae.* Galls of *Andricus terminalis.*

Geikie, Trans. County of Middlesex Nat. Hist. and Sci. Soc., Nov. 8, 1887. Host.—*Ephestia kuehniella.*

Ichneumonid Klein, Trans. Ent. Soc. Lond., 1887, Proc. p. lii–liv. Host.—*Ephestia kuehniella.*

Bracon brevicornis Billups, Trans. Ent., Soc. Lond., 1888, Proc. p. xxviii. Host.—*Ephestia kuehniella.*

Marshall, Andre's Spec. Hym. Eur., IV, 1888, p. 139. Redescription.

Bracon juglandis Ashmead, Proc. U. S. Nat. Mus., 1890, p. 62. Host.—Tineid? infesting old walnuts.

Bracon brevicornis Danysz,. Bull. Séances Soc. Ent. France, 1893, p. clxxviii.

Habrobracon hebetor Johnson, Ent. News, VI, 1895, p. 324. Host.—*Ephestia kuehniella.* Also mentions Klein's article using name *Bracon brevicornis.*

Bracon (Habrobracon) honestor Riley and Howard, Ins. Life, VII, 1895, p. 428. Misprint in specific name corrected in general index. Host.—*Plodia interpunctella.*

Bracon brevicornis Schmiedeknecht, Illust. Wochenschr. f. Ent., I, 1896, p. 541.

Bracon (*Habrobracon*) *hebetor* Chittenden, U. S. Dept. Agr. Bur. Ent. Bul. No. 8 (n.s.), 1897, pp. 38–40. Suggests possibility, according to Ashmead, of synonymy with *brevicornis*. Hosts.—*Ephestia cahiritella*, *Galleria mellonella*.

Bracon juglandis Chittenden, loc. cit. Referred to as variety of *hebetor*. Hosts.—*Ephestia cahiritella*, *Plodia interpunctella*.

Habrobracon hebetor Buchwald & Berliner, Zeitschr. f. d. gesamte Getriedewesen, II, 1910, pp. 1–4, figs. 1 and 2. Host.—*Ephestia kuehniella*.

Specimens in the National Museum determined by Ashmead and others as *hebetor* Say and *juglandis* Ashm. agree with Marshall's description of *brevicornis* Wesm. and are identical with a specimen from Europe determined by Schmiedeknecht as *brevicornis*. Chittenden (Bur. Ent. Bul. 8, p. 39) suggests, on the authority of Ashmead, that these two species are synonyms of *brevicornis* Wesm. All of the reared specimens of *hebetor* and *juglandis* in the collection are reared from hosts that breed in stored products of various sorts, principally from various species of the genus *Ephestia*. This seems to be the normal host of the species as well as of *brevicornis* in Europe. All the specimens in the National Museum that can be construed as agreeing otherwise with *hebetor* Say differ from the original description of that species in having the coxæ largely black not "yellowish-white." Furthermore, Say makes no mention of the black occipital spot which appears in all dark specimens. In the description of *Bracon dorsator* on the page following that of *hebetor*, Say observes that *dorsator* agrees with *hebetor* in that "the first cubital cellule is wider by one-third than the second at their junction." In all the specimens in the National Museum this difference is at least one-half and usually more. It seems from these facts that the specimens reared from such hosts as those mentioned above are not the *hebetor* of Say. Such being the case the *hebetor* of authors must sink into synonymy with *brevicornis* Wesm., while the *hebetor* of Say must stand as an unknown species.

Specimens of this species in the National Museum, in addition to those which agree with Marshall's description of the species, show variations of practically all grades from those in which the dorsum of the thorax and abdomen is entirely black except the apical tergite and faint traces of the thoracic markings, and the ocellar and occipital spots narrowly joined, to those in which the color is largely yellowish without the typical spots on the head, the dark color of the mesonotum reduced to three small spots and the abdomen nearly uniformly pale. In some specimens the head is practically all black with only faint indications of the color pattern. The number of antennal joints in females

varies from 13 to 15 and in males from 20 to 22. The size also varies considerably, the smallest males being about 2 mm. long and the largest females about 3 mm.

The material examined consists of nearly a hundred specimens from Illinois, Massachusetts, California, Nevada, Florida, West Virginia, Ohio, New York, and the District of Columbia together with a number of unlabeled specimens and three from Europe. Many of these were reared from such hosts as *Ephestia kuehniella*, *E. elutella*, *Plodia interpunctella*, and *Galleria mellonella.*

Habrobracon variabilis n.sp.

Female: Length 3 mm. Face and orbit yellow, this color triangularly extended inward behind the ocelli from each side so that the dark spot in which are located the ocelli is nearly separated from the dark occipital spot; antennæ 21-jointed, black, stout, tapering toward the apex, the joints of the flagellum except the first but little longer than thick; palpi yellowish.

Thorax largely dark brown above, the scutellum laterally, posterior middle of mesoscutum and the positions of the notauli testaceous; testaceous below; all legs except hind coxæ basally, hind tibiæ apically, and basal joints of hind tarsi, which are infuscated, testaceous; wings dusky, apical third hyaline, veins except costa and anterior edge of stigma pale, a small whitish spot on the base of the stigma.

Abdomen with the first tergite dark brown, pale apically, the second testaceous except for a dark spot on the basal middle and a suffused spot on each side, the third, fourth, and fifth dark brown except laterally and medially where they are testaceous, the remaining visible tergites testaceous; first tergite with the furrows crenulate, the triangle without large punctures apically, sides beyond spiracles arcuate; second tergite with a median basal embossed area, coincident with the median dark spot set off laterally by obscurely crenulate furrows, rest of tergite finely, irregularly, longitudinally rugulose; third to fifth similarly sculptured but the sculpture changing gradually until in the fifth it becomes reticulate rugulose; remaining tergites barely visible; exserted portion of ovipositor slightly less than half the length of abdomen.

Male: Length 2.5 mm. similar to female; antennæ 25-jointed, more slender, all flagellar joints distinctly longer than thick; all coxæ testaceous; first tergite pale testaceous with the triangle somewhat darker and with its sides straight; second tergite entirely yellowish.

Host.—*Canarsia hammondi.*.

Type locality.—Siloam Springs, Ark.

Type Cat. U. S. N. M. No. 18275.

Allied to *brevicornis* Wesm. from which it is at once distinguished by the distinct abdominal sculpture, the larger num-

ber of antennal joints, the entirely yellow face, and the partial coalescence of the ocellar and occipital spots.

Described from 3 females and 2 males (the type female, male, and paratypes *a*, *b*, and *c*) labeled Quaintance No. 5155, Siloam Springs, Ark., 9.26.08, S. W. Foster, collector, parasite of *Canarsia hammondi;* 2 females (paratype *d* and 1 other) labeled 440[01], issued Aug. 20, '90, Par. on *Pempelia hammondi* from Miss Murtfeldt; 2 females (paratype *e* and 1 other) from Champaign, Ill.; 3 males (paratypes *f* and *g* and 1 other) labeled Quaintance No. 5083, Siloam Springs, Ark., 6.26.08, S. W. Foster, par. of *Enarmonia prunivora;* 5 females and 2 males (paratypes *h–l* and 2 others) labeled Parasite of *Desmia funeralis*, Vienna, Va., Sept. 15, Quaintance No. 10622, J. F. Strauss, collector; 4 females (including paratypes *m* and *n*) Midvale, Pa., Sept. 1, 1913, Quaintance No. 6126, F. L. Simanton, Coll., parasite of *Laetilia coccidivora.*

This species is extremely variable in color, although the color within a series from an individual host is quite constant, varying, as a rule, only in minor details. The paratypes show all grades of variation, *e* being much paler and *k* much darker than the type female. In *e* the ocellar and occipital spots are entirely separated; mesoscutum entirely yellowish-testaceous except a narrow median line anteriorly and a suffused spot on each hind angle; scutellum pale throughout; propodeum somewhat lighter, especially laterally, where it is testaceous; legs pale, hind coxæ yellowish; stigmal spot occupying nearly half of the stigma; first tergite testaceous except triangle basally, second tergite yellow throughout; on the remaining tergites the light markings are somewhat more extensive and paler. Paratype *i* is smaller and much darker than the type, the thoracic markings practically obsolete and the color pattern of the abdomen very obscure, face with a median dark line which broadens out into a spot on the clypeus. In paratype *n* the ocellar and occipital spots are broadly joined.

Habrobracon platynotae n. sp.

Female: Length 3 mm. Head black with the face fuscous, the orbital ring, genæ, and a spot below each antenna yellowish; orbital ring broadly interrupted behind the eye with a small pale spot immediately behind the eye and not extending mesad behind the ocelli; mandibles colored like the face with black tips; antennæ black, long, 24-jointed, uniform in thickness, the basal flagellar joints about 1½ times as long as thick.

Thorax black, legs testaceous except that the apical joint of the front tarsi, the middle and hind tibiæ and tarsi, and the coxæ basally are infuscated; wings dusky with the apical third hyaline, the veins fuscous.

Abdomen testaceous somewhat infuscated especially beyond the second

[redacted]

tergite; first tergite testaceous with the anterior angle of the triangle somewhat infuscated, the furrows not crenulate, the areas shagreened; second tergite with the median embossed area distinct only basally its sides diverging rapidly, this and the base of the third tergite reticulately roughened, the third apically and the fourth and fifth entirely granularly roughened; exserted portion of ovipositor half as long as abdomen.

Male: Differs from female principally in its smaller size and in having the four anterior coxæ and femora largely blackish, and the embossed area of the second tergite indistinct.

A single female paratype agrees in all respects with the type.

Host.—*Platynota* sp.

Type locality.—Hollywood, Calif.

Type Cat. U. S. N. M. No. 18276.

Described from the above three specimens which were reared May 12, 1913, by J. E. Graf of the Bureau of Entomology.

Habrobracon xanthonotus (Ashm.)

Bracon xanthonotus Ashmead, Proc. U. S. Nat. Mus., XI, 1888, p. 618.

The only specimens of this species in the National Museum are the 14 females of the type series and two others. The type male is apparently lost. From its small size and the fact that it had fewer antennal joints than the female it must have been a dwarf and poorly developed specimen.

The only characters that I have been able to discover that will separate this from the following species are variable, and I believe that the two are conspecific, but hesitate to reduce *hopkinsi* Vier. to synonymy because of the paucity of intergrades between the two types. One of the specimens agrees with *hopkinsi* in facial markings.

Habrobracon hopkinsi Vier.

Habrobracon hopkinsi Vier., Proc. U. S. Nat. Mus., vol. 38, 1910, p. 380.
Habrobracon mali Vier., Proc. U. S. Nat. Mus., vol. 44, 1913, p. 641.

The character in which Viereck considered his *mali* to be allied with *xanthonotus*, as indicated in his description of *mali*, and in which it differs from *hopkinsi*, is found in a manuscript table to the species, and consists in the possession of testaceous markings on the mesoscutum. His description of the species consists of a statement of the differences between it and *xanthonotus*. All of the characters used are those which an examination of a large number of specimens of several of the other species of the genus shows to be subject to extreme variation. This is especially true of the color patterns of the thorax and abdomen and the number of antennal joints.

H. hopkinsi was described from a series of 18 specimens reared from *Notolophus oslari*. It is described as having the mesonotum entirely black, and yet, in the type series, there is one female that shows the testaceous markings in the position of the notauli quite distinctly. A careful examination of every specimen of the type material in both *hopkinsi* and *mali* together with another series of *mali*, reared by the writer from the same host and locality, and a large series of specimens mostly reared from *Clisiocampa pluvialis* and *C. constricta* in California, some of which resemble *hopkinsi* and some *mali*, has convinced me that the two are but variants of the same species. Aside from the mesonotal markings there is comparatively little variation in color in the species as at present limited, but in the number of antennal joints there is considerable variation. In the *hopkinsi* series the females have 24 to 25 antennal joints and the single male with complete antennæ has 25 joints; in the *Clisiocampa* series the females have 24 and the males 28 to 29 joints; and in the *mali* series the females 27 and the males 28 to 29 joints. Some of the specimens of the *Clisiocampa* series show a tendency toward *xanthonotus* in the color of the antennæ. In addition to the material mentioned above there are in the National Museum specimens from New Hampshire, California, Malden (Mass.?), and a series of 5 specimens from Yosemite, Cal., reared from a Noctuid (?) larva. The last differ from the type in being somewhat larger and in having the markings somewhat paler and more extensive, and agree with the type of *mali* in the number of antennal joints.

The *Bracon* n. sp. of Ins. Life, II, p. 349, parasitic on *Clisiocampa constricta* belongs here and is a part of the material examined.

The *Bracon gelechiæ* of New Hampshire Exp. Sta. Bul. 6, Tech. Ser., is undoubtedly this species.

Habrobracon gelechiae Ashm.

Bracon gelechiæ Ashmead, Proc. U. S. Nat. Mus., 1888, p. 623.
Bracon notaticeps Ashmead, loc. cit., p. 624.
Habrobracon gelechiæ Johnson, Ent. News, VI, 1895, p. 324.

The female of this species can at once be distinguished from *johannseni* Vier. by the greater width of the abdomen as compared to its length and to the width of the thorax and by the retraction of the terminal tergites. The male is at once distinguished by the color pattern of the abdomen, black bordered with yellow which extends nearly to the middle on the second tergite.

Comparison of the types of *notaticeps* (Ashm.) with those of *gelechiæ* proves the two species to be the same, the differentiating

characters as given by Ashmead in his description of the latter species, that is, the color of the legs and the number of antennal joints, being both very variable characters.

The only female of this species in the type series lacks entirely the yellow tergal color ascribed to the species by Ashmead in his description. Unfortunately also the head is missing. It is possible that the female and the males are of different species, the opposite sex of each of which has not been identified. The exact status in this respect can not be satisfactorily determined except by the rearing of more material under careful observation.

One female from Kansas collected by C. L. Marlatt and labeled by Ashmead *Bracon notaticeps*, which differs from the type in having the abdomen brown on the sides, has been provisionally referred to this species.

The *Bracon* n. sp. of Ins. Life, II, p. 349, parasitic on *Gelechia roseosuffusella* Clem. belongs here and is a part of the material examined.

Habrobracon johannseni Vier.

Bracon sp. Johannsen and Patch, Bul. 195, Maine Agr. Exp. Sta., 1912.
Habrobracon johannseni Viereck, Proc. U. S. Nat. Mus., vol. 42, 1913, p. 622.
Habrobracon tetralophæ Viereck, loc. cit., p. 623.

Redescription of type female.—Length 2 mm. Head black with a narrow interrupted line above and in front of the eyes dark testaceous; mandibles testaceous, black at tips; antennæ black, slender, uniform in thickness, 22-jointed.

Thorax black throughout, delicately shagreened; legs blackish, testaceous at the articulations, hind tibiæ and tarsi largely testaceous; wings hyaline with the veins brownish and the pubescence blackish, paler toward base of wing.

Abdomen black above narrowly bordered with testaceous posteriorly, about half as wide as long and about as wide as thorax, the sixth and seventh tergites extended; first tergite with the furrows narrow and not crenulate, its surface shagreened, sides beyond the spiracles straight and parallel; second tergite granularly and slightly reticulately roughened; tergites 3, 4, and base of 5 shagreened, 5 apically and 6 and 7 smooth; exserted portion of ovipositor half as long as abdomen.

This species was originally described from two specimens reared from an undetermined Tineid in pine cones at Orono, Me. In the same paper Viereck described *H. tetralophæ* from two females and a male reared at Lafayette, Ind., from *Tetralopha baptisiella*. The description of the latter species consists of a comparison with *johannseni*. The only characters used, length,

number of antennal joints, and color of hind femora, are all very subject to variation throughout the genus. The types of the two species differ also in the shape of the first tergite. In *johannseni* the sides of this segment beyond the spiracles are straight and parallel while in *tetralophæ* they are curved and slightly divergent. Examination of a large series of specimens from other sources shows that the shape of this tergite varies from the form shown in *johannseni* to those showing even more curvature and divergence than in the type of *tetralophæ*. In all of the males the first tergite is of the form exhibited by the type of *johannseni*.

Besides one of the type specimens of *johannseni* and three of *tetralophæ* the following material was examined: a large series reared by J. E. Graf at Los Angeles and El Monte, Calif., from *Phthorimea operculella* under Chittenden No. 2229; 3 specimens from the same host at Norfolk, Va., Chittenden No. 2721^{a}; 12 females and 1 male from *Desmia funeralis* in Fairfax Co., Va., Quaintance No. 5569, J. F. Strauss; 2 females from the same host from the Ashmead collection; 1 female from Riley Co., Kans., Marlatt; 2 females from Champaign, Ill., 2 females from Oswego, N. Y.; 2 females from Salineville, Ohio; 1 female from Franklin Co., Ark., Webster; and 1 female from Agr. Coll., Mich. All the California parasites of *Phthorimea* resemble the type of *johannseni* in color except that the light margin of the abdomen is somewhat more distinct. In this series nearly all gradations in the shape of the first tergite are found. The Virginia parasites of *Desmia* agree in color of the legs with *tetralophæ* and show some variation in the shape of the first tergite, but are mostly somewhat larger than the types. The New York specimens agree with *tetralophæ* except that the orbital ring is somewhat paler and more distinctly defined. In the Kansas specimen the black color of the abdomen is replaced by brown, and the border is yellow, while all of the legs are pale. In the two specimens reared from *Desmia* without locality and the two Illinois specimens the reduction of the abdominal color is carried still further, while the mesopleuræ and pronotum laterally are more or less testaceous to yellowish. The number of antennal joints in the female varies from 19 to 36, the smaller specimens having the smaller numbers. In the males of the *Phthorimæa* series the antennæ are from 23 to 27 jointed; neither of the other males has the antennæ entire.

Two Hundred and Seventy-Sixth Meeting, April 2, 1914.

The following program was presented:

Notes on Some Microlepidoptera on Forest Trees with Descriptions of New Species .... August Busck[1]
Descriptions of two Parasitic Hymenoptera .... S. A. Rohwer[2]
Aquatic Insect Life at Castle Hot Springs, Arizona .... E. A. Schwarz[1]
Notes on some Beetle Larvæ from Arizona .... Dr. Adam Böving[1]
Concerning some Aphelininæ .... L. O. Howard[3]
Descriptions of New Chalcid-flies .... A. A. Girault

DESCRIPTIONS OF NEW CHALCID-FLIES.

By A. A. Girault.

Genus Anaphoidea Girault.

Anaphoidea luna new species.

Female: Length, 0.50 mm. Black, the scape, pedicel and proximal three tarsal joints dusky lemon yellow, the trochanters and knees pallid; wings obscurely, slightly fumated, subhyaline; cephalic tibiæ lighter.

Differs from the other European species, *diana* Girault, in being black instead of brown, in having the second funicle joint more than twice the length of the first and only slightly shorter than the third. In regard to the three North American species, it is most similar to *pullicrura* with which it may be confused; however, upon comparison of specimens, *pullicrura* is seen to differ in that the fore wings are more deeply infuscated and not quite so broad, their caudal margin more concavely curved and the scape and pedicel are darker. Also in *luna* the midlongitudinal line of discal cilia is longer and may include as many as eleven cilia. Otherwise I cannot distinguish between the two. It is distinct from other North American species. Of the Australian species (*harveyi*, *galtoni*, *linnæi*) it is distinct from all excepting *linnæi*, which it resembles closely. However, *linnæi* differs in that the proximal tarsal joints are longer, the legs lighter, the fore wings more deeply infuscated, the scape and pedicel dark. The Australian *linnæi* is thus allied with the North American *pullicrura* (from which it differs mostly in bearing longer proximal tarsal joints) and this European species, the three distinguishable only on very slight differences and yet undoubtedly distinct species.

From three specimens, two-third-inch objective, 1-inch optic, Bausch & Lomb.

[1] Will be published later.
[2] See page 141.
[3] Published in these Proceedings Vol. XVI, No. 2.

Male: The same but the scape and pedicel still lighter; antennæ nearly similar to those of male *pullicrura* but the flagellar joints lengthen slightly distad instead of shortening, funiclar joints 3-6 subequal, each about a sixth longer than either joint 1 or 2.

From three specimens, similarly magnified.

Described from three specimens of each sex mounted together on a slide received for study from Prof. F. M. Webster through the kindness of Dr. L. O. Howard, the slide labelled "6655. Mymarid parasites of *Phytonomus* (from shipment from Italy by Fiske). Salt Lake City, April 8, 1911. T. H. Parkes."

Habitat: Europe, Italy (Portici); North America (imported) —Utah (Salt Lake City and Murray).

Host: Phytonomus posticus Gyll.

Types: Cat. No. 15452, United States National Museum, Washington, D. C., the above specimens—three males and three females.

My attention was drawn to the existence of this species by looking over Bull. No. 112, Bureau of Entomology, U. S. Department of Agriculture, where on page 35 it is stated that a Mymarid egg-parasite, *Anaphes* species, was found in seven shipments of the Phytonomus from Italy. On the preceding page (fig. 15) an enlarged figure of the male and the female antenna is given. At the time, the figure looked to me like *Anaphes pratensis* Foerster, the only European Mymarid recorded from North America. I was therefore anxious to receive specimens, and my application to Professor Webster, the author of the bulletin mentioned, resulted in the receipt of a slide bearing the six specimens of the foregoing species of *Anaphoidea*. Thus, if the figure is correct. there must be two distinct species of egg-parasites concerned. Having a North American (Urbana, Illinois, May 7, 1911) specimen of the *Anaphes pratensis* I compared it with the figure given in the bulletin and though I cannot be certain, the agreement of the figure of the female antenna with my specimen is perfect. The tarsi and wings, however, do not agree and if there has been no error in the figure, the latter represents a species of *Anaphes* different from *pratensis*.

GENUS ALAPTUS Haliday.

Alaptus animus new species.

Female: Length, 0.24 mm. Black suffused with dark brown, the legs and antennæ pale but touched in places with dusky, the antennal club black, contrasting. Fore wings subhyaline, dusky under the venation; posterior wings dusky, maculate with whitish. Fore wings narrow, with a midlongitudinal line of from four to five discal cilia, the line rather short and

somewhat distad of the mid-distance between apex of venation and apex of wing. Antennæ with the proximal funiclar joints more or less cylindrical, joint 1 short, barely longer than wide, somewhat shorter than funiclar joint 3; joint 2 nearly longest, twice longer than wide but subequal to joints 4 and 5 which are cylindrical ovate; club long, slender, conic-ovate, subequal in length to the funicle. Pedicel somewhat longer than any of the funiclar joints.

Of the Australian species, closest to *newtoni* Girault, from which it may be distinguished by its darker body coloration, the pale antennal funicle contrasting with the dark club and the comparatively great length of the latter.

Male: Not known.

Described from two females captured on windows in a private residence at Nelson, North Queensland, November 22, 1912, 16th-inch objective, 1-inch optic, Bausch & Lomb.

Habitat: Australia, Nelson (Cairns), Queensland.

Types: No. Hy. 1289, Queensland Museum, Brisbane, the foregoing specimen on a slide in xylol-balsam.

Alaptus maccabei new species.

Alaptus immaturus Perkins, *partim.*

Female: Length, 0.33 mm. Black suffused with some brown, the legs either pallid or dusky, the scape and pedicel pale yellowish.' Like *immaturus* Perkins, as identified in the paper on Australian Mymaridæ (Girault, 1912)[1] but the body much darker and the line of ciliation in the disc of the wing is much longer, extending from apex to the venation. The thorax is somewhat paler.

Male: Not known.

Described from the two females from Nelson and Herberton, Queensland, identified as *immaturus* Perkins in my paper on Australian Mymaridæ (Part II, Australian Hymenoptera Chalcidoidea).[1] The species may be merely a variety of *immaturus;* the specimen of the latter, as identified by myself, had the head and abdomen dark brown, the thorax pale lemon yellow.

Habitat: Australia, Nelson and Herberton, North Queensland.

Type: No. Hy. 1290, Queensland Museum, Brisbane, one female in balsam (Herberton, Q., 28 Dec., 1911) mounted with the type female of *Litus schleideni* Girault.

Respectfully dedicated to Joseph McCabe, the former Roman Catholic priest, now writer on the philosophical questions of the time.

[1] Memoirs Queensland Museum. Brisbane, I.

PARANAPHOIDEA new genus.

This genus, captured quite accidentally, appears to me to be quite remarkable in its family, since it bears one or two unique characteristics. The venation is like that of *Stethynium*, the antennæ like those of *Anaphoidea* but the posterior wings are very broad for the family, nearly like those in the Eulophidæ yet distinctly pedicellate at base. The abdomen bears a distinctly exserted ovipositor. This genus, for the present, I consider allied with *Anaphoidea.*

Female: Head normal, the lateral ocelli distant from the eyes, the antennæ inserted about in the middle of the face, 10-jointed, the club obliquely divided, the pedicel as long as any of the funiclar joints which, excepting the small first, are all subequal and oval. Tarsi 4-jointed, the first joint long, the tibial spurs single, those of the cephalic legs, longest, long and very slenderly acute, straight, *not forming a strigil.* Fore wings shaped as in narrow-winged species of *Gonatocerus* but nearly truncate at apex, the venation like that in *Stethynium*, there being a foot-shaped stigmal vein, quite half as long as the marginal; marginal cilia very short. Abdomen as long as the thorax, oval, sessile but the phragma *apparently* absent; ovipositor very long, exceedingly fine and slender, inserted at extreme base of abdomen, exserted with its valves for a length equal to *half* that of the abdomen and curved. Posterior wings broad and knife-shaped, bearing about seven lines of sparse discal cilia, the blade over a third the width of the fore wings, before venation with a slender petiole. Parapsidal furrows complete; scutellum wider than long; axillæ not noticeably advanced, widely separated; pronotum not extending back to the tegulæ; meso-postscutellum as long as the scutum.

Male: Not known.

Type: The following new species.

Paranaphoidea egregia new species.

Female: Length, 0.70 mm., excluding ovipositor. Black, uniquely marked with golden yellow as follows: The mesopostscutellum golden yellow with the exception of a prominent, long, elliptical black marking on each side of the median line and an oblique dash laterad; caudad, the scutum at the caudal margin and mesad with a V-shaped golden yellow marking; the face; on the vertex, a slender line of yellow runs over the cephalic ocellus from eye to eye, laterad widening caudad and cephalad, leaving in the centre of the vertex, two subrectangular areas, before and behind the cephalic ocellus; the margins of the axillæ; lateral portions of each parapside, irregular. Legs golden yellow, the tarsi dusky, also the middle of the caudal femora; antennæ yellow washed with black, the club darker. Wings hyaline; fore wings bearing about twenty-six lines of discal cilia, the ciliation dense, abruptly disappearing some distance out from the venation.

Posterior marginal cilia of caudal wings not as long as the blade's width but yet over twice longer than the longest cilia of the fore wing; distal club joint much longer than proximal.

From one specimen, ⅔-inch objective, 1-inch optic, Bausch and Lomb.

Male: Not known.

Described from a single female specimen captured from a window pane in a private residence at Nelson, North Queensland, December 6, 1912 by Mr. Alan P. Dodd to whom I am indebted for the specimen.

Habitat: Australia, Nelson (Cairns), Queensland.

Type: No. Hy. 1291, Queensland Museum, Brisbane, the above described specimen on a slide in xylol-balsam.

GENUS PODAGRION Spinola.

Podagrion beneficium new species.

Female: Length, 2.5 mm.; with ovipositor, 5.25 mm. Dark metallic green with aeneous and bright bluish tinges; the face brighter green; exserted portion of ovipositor black; antennæ black, excepting the dark metallic scape which is rufous laterad and centrad but sometimes wholly black; trochanters, knees, tibiæ and tarsi rufous, the coxæ and femora concolorous with the body, the caudal tibiæ blackish for distal four-fifths; distal tarsal joint black, the posterior tarsi often pallid yellowish. Oral area black. Wings hyaline, the venation dusky. Teeth of posterior femora black; immediate base of abdomen more or less slightly rufous especially ventrad at proximal half. Eyes and ocelli concolorous, garnet. Mandibles black at tip. Bright metallic blue especially on the abdomen and legs.

Lateral ocelli their own diameter from the eye margin. Head all over and dorsal thorax densely polygonally sculptured or punctate, the punctures moderate to fine, the abdomen, coxæ and femora polygonally reticulated, the sides of the pro- and meso-thorax more roughly so. Genal suture fine but distinct. Head, antennæ and thorax bearing short, greyish, moderate pubescence; also on the posterior segments of the abdomen and the legs. Posterior femora with six large teeth and a seventh minute one just proximad of the fifth tooth. Metathorax with a conspicuous v-shaped median carina whose apex is at the meson cephalad; the large area cephalo-laterad of each branch of the carina is densely punctuate nearly like the scutellum while the mesal area included by the two branches of the carina is the same but also traversed by an irregular, narrow median carina which sends off oblique shoots making the area rugose. Laterad there are no carinæ excepting a thin longitudinal one a slight distance laterad of the spiracle. The metathoracic spiracle is elliptical and slightly curved at one end, thus subreniform. A fovea is just caudad of it.

Marginal vein of fore wing long but shorter than the submarginal, the

post-marginal vein short but longer than the stigmal. Antennæ 13-jointed, with one ring-joint which is distinct; funiclar joints shortening distad, the distal two distinctly wider than long, the first two subequal, a fourth longer than wide, each slightly longer than the pedicel; joint 3 quadrate; joints 4 and 5 subequal, slightly wider than long, while joints 6 and 7 are subequal, each slightly shorter than joint 5; club long, ovate, much wider than the funicle, its three joints subequal in length and as long as the proximal joint of the funicle. Mandibles dentate.

From many specimens, 2/3-inch objective, 1-inch optic, Bausch and Lomb.

Male: The same but the funiclar joints are all distinctly longer, the club shorter, not wider, or scarcely, than the funicle, its distal joint short; antenna lighter distad and the abdomen differs as it should for this sex in this genus. The proximal funiclar joint is nearly twice longer than wide, longer than the second joint and none of the joints of the funicle are wider than long.

From many specimens, the same magnification.

Described from twenty-seven pairs reared at the same time from two common large mantid egg masses taken from trees in a forest near Nelson, N. Q., June 25, 1912. The young mantids and the parasites issued on July 4. The hosts were of the same species and the egg masses were of the usual form.

Habitat: Australia, Nelson near Cairns, North Queensland.

Types: No. Hy. 1170, Queensland Museum, Brisbane, two males, two females, on cardpoints, four pins. *Cotypes*—Cat. No. 15361, United States National Museum, Washington, D. C., two pairs on cardpoints.

This species is allied to *olenus* Walker but has a lateral carina on the propodeum and the median carina is divided at the immediate base of the segment.[1]

GENUS ASAPHES Walker.

Asaphes americana, new species.

Female: Length, 2.00 mm. Dark metallic green, the coxæ concolorous, the legs yellow, pallid yellow at the tarsi; wings hyaline; antennæ black;

[1] The following notes comparing this species with *P. olenus* Walker are added at the request of the author. The cotypes sent were shipped in a vial together with a ball of cotton, just the size to roll back and forth in the vial so that the specimens were almost completely dismembered when they arrived.

In *P. olenus* Walker the antennæ are rufous with the pedicel much longer than the first joint of the funicle, there are usually six teeth (counting the apical one which is bidentate at apex, as two) on the hind femora and all about equal in size (in *beneficium* some of the medial teeth are much smaller than the rest); front and middle legs brown with no greenish tinge.

In the male cotypes sent the hind femora have only three teeth larger than in the female and so in this respect are not similar to the female.

femora suffused with fuscous. Venation smoky brown. Marginal vein subequal to the long stigmal, the post-marginal vein somewhat longer. Cephalic tibial spur forming a strigil. Antennæ 13-jointed with 2 ring-joints the second of which is rather large, twice the size of the first, which is larger than the usual ring-joint; the funiclar joints widening distad, all wider than long and shorter than the pedicel; joints 1–3 of the funicle subequal, each twice the size of the second ring-joint; funiclar joints 4 and 5 subequal, somewhat larger, 6 still somewhat larger; club ovate, not wider than the last funiclar joint, the 3 joints subequal, each somewhat longer than joint 6 of the funicle. Scape long and slender. Body polygonally sculptured.

From four specimens, ⅔-inch objective, 1-inch optic, Bausch and Lomb.

Male: Length, 1.75 mm. The same but the abdomen is rounded and depressed, the antennal club more thickened and stouter, wider than the distal funiclar joint; the flagellum is yellowish white, the pedicel dark, the ring-joints more or less dusky.

From one specimen, the same magnification.

Described from one male and four females mounted singly in balsam.

Received for identification from R. L. Webster of the Iowa Agricultural Experiment Station and labeled as follows: "Exp. 101, 12 and 13 June, 1912. From Hampton, Ia. R. L. Webster," 2 slides 1 ♂, 1 ♀; "Exp. 102. June 12, 1912. From Hampton, Iowa, R. L. Webster," 1 ♀; "Exp. 147, 27 June, 1912. Ames, Iowa. R. L. W.," 1 ♀; and "Exp. 164, 26 June, 1912. Ames, Ia. R. L. W."

Habitat: North America—Ames and Hampton, Iowa (U. S. A.).

Types: Cat. No. 15655, United States National Museum, Washington, D. C., the five slides as above.

This species differs from *vulgaris* Walker in having the legs light yellow instead of ferruginous with darker femora, and in having the pedicel shorter.

Genus Elasmus Westwood.

Elasmus proserpinensis new species.

Female: Length, 2.00 mm. Like *flavipostscutellum* (the postscutellum whitish except along extreme base) but the abdomen is wholly shining black, the legs distinctly more colored, only the articulations and tibiæ pallid yellow; and the tegulæ and scape are pale yellow. Vertex rather densely umbilicately punctate; femora and coxæ sculptured. Antennæ 10-jointed, with the first ring-joint very short, hidden; differing from those of flavipostscutellum in that the proximal funiclar joint is distinctly longer than the pedicel and the joints are all somewhat longer; the proximal club joint forms nearly half of that region. The mandibles bear seven teeth, three

outer (lateral) large ones and four small inner ones. Occiput wholly black. Wings hyaline.

From one specimen, ⅔-inch objective, 1-inch optic, Bausch and Lomb.

Male: Not known.

Described from a single female specimen captured while sweeping foliage and grass on a forest-meadow near the town of Proserpine, Q., November 2, 1912.

Habitat: Australia, Proserpine, Queensland.

Type: No. Hy. 1278, Queensland Museum, Brisbane, the foregoing female on a tag, plus the head crushed in xylol-balsam.

In my table of the Australian species of the genus, this species falls in with its ally, *flavipostscutellum*.

Elasmus cyanella new species.

Male: Length, 1.50 mm. Like *cyaneus* but the postscutellum has a transverse yellowish line across it and the cephalic femora are as dark as the others, as are also the proximal tarsal joints. The fourth antennal joint of the female is very long, about twice the length of the club; the proximal club-joint forms half of the club. The mandibles are 5-dentate, three small inner teeth, two larger, unequal, outer ones, the second tooth longest.

From one specimen, magnified as above.

One male captured by sweeping grass in a forest near Proserpine, Q., November 3, 1912. This species may be the male either of *cyaneus* or else of *proserpinensis*. It nearly agrees with *cyaneus* in all excepting the yellow on the postscutellum and minor mandibular characters; it differs from *proserpinensis* in general body coloration and in bearing two less mandibular teeth.

Habitat: Australia, Proserpine, Queensland.

Type: No. Hy. 1279, Queensland Museum, Brisbane, the above male on a tag plus the head crushed on a slide in xylol-balsam.

Elasmus flavipostscutellum Girault.

This species was captured at Proserpine, Queensland, by sweeping grass in a forest, November 3, 1912; a female, also a male at the same time. On this male the band of the abdomen was lemon yellowish with a silvery tinge and the postscutellum had only a lemon yellow stripe across it near base, the caudal coxæ dark only along dorsal margins.

Elasmus minnehaha new species.

Male: Length, 1.20 mm. Dark metallic green the abdomen with a yellowish band around it just out from the base; cephalic legs pale yellow, including coxæ; all of tibiæ the same color; intermediate and caudal coxæ black except at tips; intermediate femora black except for some distance from each end; caudal femora black at distal half except at tip, pale yel-

low at proximal half or nearly, the proximal margin of the black cuneately scooped out. Tarsi dusky. Wings subhyaline. Fourth funiclar joint longer than the club. Mandibles 5-dentate.

From one specimen, similarly magnified.

Female: Not known.

Described from a male captured by sweeping foliage and grass in an open forest at Proserpine, Queensland, November 3, 1912. Like *impudens* but differing in the coloration of the legs and abdomen, the band of the latter much broader; also somewhat like *minor* but differing in the coloration of the legs, especially the femora.

Habitat: Australia, Proserpine, Queensland.

Type: No. Hy. 1280, Queensland Museum, Brisbane, the above male mounted in xylol-balsam.

Later, a second male was found, collected at the same time; in this specimen the femora were nearly wholly black.

Elasmus fasciativentris new species.

Female: Length, 2.5 mm. Metallic green but very dark, the proximal two-thirds of the abdomen orange yellow, immaculate and extending farther caudad on the venter but along the dorsum crossed by four conspicuous broad blackish bands, the widest of which is at the base of the abdomen and is metallic; there are thus in the centre of the dorsum three broad black bands of about equal width and not extending into the dorso-lateral aspects. Tip of abdomen black for some distance (about distal third). Tegulæ, postscutellum, oral area broadly, scape and legs pale lemon yellow, the latter still paler, including the coxæ, the tarsi blackish, the caudal coxa with its proximal two-thirds metallic green, the caudal tibia with the usual arrangement of black spines. Flagellum blackish, the pedicel lighter. Wings subhyaline, the venation dark. Funiclar joints subequal, longer than wide, the first somewhat longest, longer and stouter than the pedicel. Face with thimble punctures.

From one specimen, similarly magnified.

Male: Not known.

Described from a single female captured by sweeping grass and foliage in a forest at Nelson, N. Q., November 28, 1912 (Alan P. Dodd).

Habitat: Australia, Nelson (Cairns), N. Q.

Type: No. Hy. 1292, Queensland Museum, Brisbane, the above specimen on a tag.

Elasmus australiensis has the postscutellum wholly lemon yellow; also *vicinus;* the latter should therefore be grouped with *flavipostscutellum; insularis* has a narrow transverse yellow band across the base of the same sclerite.

UFENSIA new genus.

Female: The same as *Ufens* in all structures, but the abdomen is longer, pointed conic-ovate, longer than the thorax, the ovipositor long, inserted at base of abdomen and distinctly exserted, the valves projecting beyond the tip of the abdomen for a length equal to about a third or somewhat less, the abdomen's length. Marginal and stigmal veins short, the former nearly a third shorter than the latter which is well-developed. Strigils absent. Mandibles apparently tridentate. The funicle twisted, the club 3-jointed.

Male: Not known.

This genus is omitted from my table of Australian genera of the family now (October, 1912) in course of publication; it would fall near *Neobrachistella* Girault because of the exserted ovipositor.

Type: The following species.

Ufensia pretiosa new species.

Female: Length, 1.00 mm., including the ovipositor which is about 0.20 mm. long. Similar to the Australian species of *Ufens* (more nearly to *hercules*) but differing in specific details. Black, the head except occiput and the base of the abdomen in the centre of the dorsum, orange yellow. Antennæ dusky pallid, the club more or less obscurely banded by two pallid bars. Legs black, the articulations, knees, tips of tibiæ and proximal two tarsal joints white, the posterior tibiæ nearly all white, the proximal two-thirds obscurely dusky. Wings hyaline, the venation black. Ovipositor black. Posterior wings with three long lines of discal ciliation, the fore wings bearing about nineteen lines. Marginal cilia of fore wing very short. Distal tarsal joint longest.

From a single specimen, $\frac{2}{3}$-inch objective, 1-inch optic, Bausch and Lomb.

Male: Not known.

Described from a single female captured by sweeping grass in a forest near Nelson, N. Q., October 10, 1912.

Habitat: Australia, Nelson near Cairns, Queensland.

Type: No. Hy. 1173, Queensland Museum, Brisbane, the foregoing female in xylol-balsam mounted with an *Oligosita*.

GENUS PROSPALTELLA Ashmead.

Prospaltella bears an oblique, short but nonsessile stigmal vein; *Coccophagus* bears usually a short sessile one, at right angles to the marginal vein as in the Entedonini.

Prospaltella nigrifemur new species.

Female: Length, 0.75 mm., including ovipositor. Sooty black, the wings hyaline, the ovipositor exserted for a fourth (more or less) the length of the

[redacted]

abdomen. Legs pale whitish except coxæ, hind knees and femora and proximal portions of other femora. Antennæ dusky pallid, the funiclar joints all about twice longer than wide, the club-joints a little shorter, the flagellum filiform; pedicel distinctly shorter than the funiclar joints taken separately. Thorax finely reticulated. Hind wings with six lines of discal cilia, the lines in pairs—middle, caudal and cephalic—the hooklets distad of the middle of the blade, the caudal marginal cilia slightly shorter than the greatest width (at the hooklets). Fore wings with about fifteen lines of discal cilia, the longest marginal cilia distinctly shorter than the same cilia of the hind wing. Ovipositor white, the valves black. Terminal segment of abdomen shortly conical, the valves of the ovipositor extruded beyond it for about its own length (that is, the length of the terminal segment.)

Male: Not known.

Described from fifteen females "from *Aleurodes* sp. on *Ficus*, June 13, 1913."

Habitat: Passoeroean, Java.

Types: Seven females on a slide (Queensland Museum).

GENUS TRICHOGRAMMA Westwood

Trichogramma australicum Girault.

A female agreeing with the description of this species from the eggs of *Grapholita schistaceana*, Passoeroean, Java, Sept. 15, 1913 (P. van der Goot). Also many specimens from *Diatrœa striatalis*, Passoeroean, August 25, 1913 and from the eggs of *Chilo infuscatellus*, Passoeroean, August 20, 1913 (P. van der Goot).

In regard to some of these specimens van der Goot wrote: "These I am mainly sending you, because I can't make sure myself whether they ought to be ranged under *Trichogramma* or *Trichogrammatoidea*. I find very minute, little knoblike appendages on the funiculus and the four last antennal joints of all." In the specimens of *australicum* from *Chilo*, I also observed these organs quite as they occur in *Trichogrammatoidea*; they were on the female funicle. *Trichogrammatoidea*, thus, is not characterized by bearing these minute organs but solely by the different male antenna and the longer marginal fringes on the fore wing.

It strikes me that the occurrence of these organs is very rare in *Trichogramma*, since I have never seen them before. Are they conidial spores of fungi?

Two Hundred and Seventy-Seventh Meeting, May 7, 1914.

The following program was presented:

On Parthenogenesis . . . . A. C. Baker[1]
The Cotton Boll Weevil in Cuba . . . . G. N. Wolcott
Classification of Cerambycid Larvæ Subfamily Prioninæ . . . F. C. Craighead[1]
The Present Status of Muscoid Taxonomy on the Basis of Reproductive Characters . . . . J. M. Aldrich[1]

THE COTTON BOLL WEEVIL IN CUBA.

By G. N. Wolcott, *Porto Rico Board of Agriculture.*

The earliest record of the boll weevil in Cuba was made by Suffrian[2] in 1871, at which time he recorded it from Cardenas and San Cristobal.

It was next recorded from the island by Gundlach[3] in 1891.

After the American occupation of Cuba the boll weevil began to attract considerable attention. In 1902 it became quite injurious to cotton at Cayamas. Mr. Schwarz visited this locality in 1903 and published his report in the Proceedings of this Society.[4]

The next notice of the insect's occurrence in the island was published by Mr. Cook[5] in 1906, at which time he reported it from Santiago de las Vegas, in addition to places previously reported.

While in Cuba during the winter of 1911–12 a few observations were made on the presence, or rather the absence of the cotton boll weevil. I was fortunate in meeting Mr. H. A. Van Hermann on the occasion of the visit and he told me that when he came to Cuba about a dozen years ago, there was a great increase in the acreage devoted to the cultivation of cotton, but that the boom was suddenly checked by a plague of boll weevils which entirely destroyed the crop for a series of years. His observations were made at the grounds of Estacion Agronomica at Santiago de las

[1] Withdrawn for publication elsewhere.

[2] E. Suffrian. Verzeichniss der von Dr. Gundlach auf der Insel Cuba gesammelten Rüsselkäfer. Archiv. f. Naturg., vol. 37, Jahrg. 13, pt. 1, pp. 130-131.

[3] Juan Gundlach. Contribucion a la entomologia Cubana, vol. 3, pt. 5, p. 285.

[4] E. A. Schwarz. The cotton boll weevil in Cuba. Proc. Ent. Soc. Wash., vol. 6, pp. 13-17. January 15, 1904.

[5] Mel T. Cook. Insectos y enfermedades del algodon. Primer Informe Anual de la Estacion Central Agronomica de Cuba, pp. 178-180, 1 fig. 1906.

Vegas, and at other points in Havana and Pinar del Rio provinces. Immediately following this serious outbreak of the boll weevil, the production of cotton became so unprofitable that none at all was planted, except for a few small plots at the Estacion. This alone would not have caused the extermination of the boll weevil, as numerous tree cotton plants remained, growing wild or in dooryards, which would furnish a constant food supply. A series of violent hurricanes, however, subsequently destroyed all the large cotton trees in western Cuba.

When Mr. P. P. Cardin arrived at the Estacion Agronomica in 1908 or 1909, he found no boll weevils on the cotton growing there and he has collected none in all the time he has been entomologist there. When I arrived in November, 1911, a thorough search was made for the weevil in the plants at the Estacion and they were examined every month thereafter until my departure in May, 1912, without success.

Mr. Van Hermann also told me of Sr. Lorenzo Sanchez who was attempting to grow cotton at Artemisa, Pinar del Rio Province and seemed to be having considerable success. I visited Mr. Sanchez' place, Finca Consolacion, a plantation of the Artemisa Tobacco Co., about a mile west of Artemisa, on May 3, 1912. Mr. Sanchez has been growing cotton for three years, each year putting in an increased acreage, and had never seen any boll weevils in his cotton. I was unable to find any, although a careful search was made. He said he knew of no tree cotton anywhere for miles around which might serve as food plants for the weevil during the years when no cultivated cotton had been grown in western Cuba. He stated that one of the errors of those who grew cotton years ago was to plant in May or June, with the beginning of the rainy season and to attempt to harvest the crop in the early months of the dry season, December or January. He had adopted an entirely different plan of cropping, as the cotton was planted towards the end of the rainy season, October or November, and harvested in the spring before the rains began. At the time I was there, most of the cotton had been picked out, his plants had dropped most of their leaves, had turned brown and there were very few immature bolls.

During January and February, 1914, I visited Cuba and again examined the cotton at Estacion Agronomica but found no boll weevils. On January 13th, I visited the Harvard Experiment Station, conducted by Mr. Robert M. Grey of Central Soledad, Cienfuegos, Santa Clara Province. Mr. Grey stated positively that he had known the boll weevil as long as he had been in Cuba (20 years) and that it was undoubtedly present in the vicinity of Cienfuegos at the present time. Neither of us were able to find any weevils, or any indications of their presence, on several bushes

of tree cotton and plants of cultivated (similar to Sea Island) cotton.

On February 13, 1914, at a scattering collection of houses and a "tienda" (country store) called Bejuquero, Central Chaparra, Oriente, I found in the dooryard of one of the houses, three cotton plants (similar to Sea Island) which had matured quite a number of bolls, but would probably mature very few more, as most of the squares had been punctured by the boll weevil. I collected eight adults, all but two of which were destroyed by "hormiga brava," *Solenopsis geminata*, a few days later. One cotton plant at Vedado, Central Chaparra, only about five miles from Bejuquero, examined February 20, showed no injury by the weevil and no adults were found. Some cotton plants in a dooryard in the village of Chaparra showed no injury by weevil and I found no adults. No cotton is grown commercially at Chaparra, so far as I was able to learn, although I enquired specifically regarding this point of Mr. Pupo, who has charge of all the sugar cane field inspection work, and I saw no other volunteer cotton plants during my stay of over three weeks at Central Chaparra.

I also visited the island of Jamaica during March, 1914. I found no boll weevils on any of the varieties of cotton grown at Hope Gardens, Kingston. Haytian cotton was most abundant, although I examined plants of Sea Island, or what was possibly Cuban commercial cotton, and of the ordinary upland variety of the South. I was informed that this was the only cotton on the island of Jamaica.

NOTES ON THE CHALCIDOID FAMILY CALLIMOMIDAE.

By J. C. Crawford, *U. S. National Museum.*

Since a new subfamily is described I have given, to locate this as well as two others characterized since the publication of Dr. Ashmead's monograph, a table based on his but much abbreviated. For additional characteristics his table should be consulted. Attention is again called to the fact that the Megastigminæ possess two well developed apical spurs on the hind tibiæ. No specimens of either the Pulvilligerinæ or the Eutanycorminæ have been seen and they are placed in this table solely from the original descriptions.

TABLE OF SUBFAMILIES.

1. Mesothoracic furrows not well defined, the scapulæ scarcely or indistinctly separated; abdomen in female conically pointed, ovipositor not exserted..Ormyrinæ
   Mesothoracic furrows well defined.. 2
2. Hind tibiæ with one apical spur..................Erimerinæ new subf.
   Hind tibiæ with two apical spurs.. 3
3. Stigmal knob greatly dilated.. 4
   Stigmal knob not greatly dilated.. 5
4. Male antennæ with whorls of hair.......................Pulvilligerinæ
   Male antennæ without whorls of hair...................Megastigminæ
5. Antennæ densely pilose; no postmarginal vein..........Eutanycorminæ
   Antennæ not densely pilose; postmarginal vein developed............ 6
6. Posterior margin of mesepisternum incised.......................... 7
   Posterior margin of mesepisternum straight.......................... 8
7. Stigmal vein long..Idarninæ
   Stigmal vein short, the stigmal knob subsessile...........Callimominæ
8. Hind femora not much swollen, their tibiæ not arcuate. Monodontomerinæ
   Hind femora much swollen, their tibiæ arcuate...........Podagrioninæ

ERIMERINAE NEW SUBFAMILY.

Erimerus new genus.

Hind tibiæ with only one apical spur, this very well developed; antennæ 13 jointed, the ring joint distinctly longer than broad, but narrower than the first joint of the funicle; parapsidal furrows well defined; mesepisternum not excised on posterior margin; scutellum without a cross furrow; propodeum longitudinally rugulose; the postmarginal vein almost as long as the marginal which is short; stigmal knob subsessile, with two appendiculations; basal abdominal segment not excised medially at apex.

Type of the genus: *Torymus wickhami* Ashmead.

In addition to the two type specimens there are in the collection three females from Central, Utah, bred July 13, 1911, by Mr. C. N. Ainslie [under Webster no. 5010 (Bureau of Entomology, U. S. Department of Agriculture)] from galls on *Hilaria*.

TABLE OF GENERA OF THE MONODONTOMERINÆ.

1. Antennæ with 2 ring joints.. 2
   Antennæ with only 1 ring joint...................................... 4
2. Front femora much swollen, pronotum very long *Plesiostigmodes* Ashm.
   Not as above.. 3

3. Spiracles at extreme base of propodeum..........*Dimeromicrus* Cwfd.
   Spiracles about their own length caudad of base of propodeum
   Idiomacromerus new genus
4. Scutellum with a cross-furrow before apex.......................... 5
   Scutellum without a cross-furrow before apex....................... 8
5. Apical margin of first abdominal segment deeply incised medially.. 6
   Apical margin of first abdominal segment not deeply incised medially 7
6. Spurs on hind tibiæ apical....................*Monodontomerus* Westw.
   Spurs on hind tibiæ much before apex...........*Perissocentrus* Cwfd.
7. Hind femora with 2 large teeth......................*Physothorax* Mayr
   Hind femora with 1 large tooth....................*Plesiostigma* Mayr
8. Metathorax with spiraclar sulci...................*Hemitorymus* Ashm.
   Metathorax without spiraclar sulci................................ 9
9. Occipital foramen surrounded by a carina.......................... 12
   Occipital foramen not surrounded by a carina...................... 10
10. First abdominal segment deeply incised medially at apex.......... 11
    First abdominal segment not incised medially at apex; propodeum
    not with 2 medial carinæ....................*Microdontomerus* Cwfd.
11. Propodeum medially bicarinate....................*Ditropinotus* Cwfd.
    Propodeum medially not carinate..........*Antistrophoplex* new genus
12. Apical margin of first abdominal segment not incised medially..... 13
    Apical margin of first segment incised medially.................. 14
13. Eyes conspicuously hairy............................*Oligosthenus* Först
    Eyes not conspicuously hairy...................*Cryptopristus* Först. ♂
14. Wings without a stigmal cloud..................................... 15
    Wings with a stigmal cloud.....................*Cryptopristus* Först. ♀
15. Hind femora with a large tooth or prominent dentiform angle;
    metathorax not with two medial carinæ........................ 16
    Hind femora without a large tooth or dentiform angle; metathorax
    with two medial carinæ ♀, in ♂ obsolete......*Eridontomerus* Cwfd.
16. Propodeum with a medial carina.............*Zaglyptonotus* new genus
    Propodeum not carinate medially................................ 17
17. Hind femora basad of large tooth distinctly serrate.*Websterellus* Ashm.
    Hind femora basad of large tooth not with small teeth or serrations
    Holaspis Mayr.

IDIOMACROMERUS new genus.

Occipital foramen margined, first abdominal segment incised medially at apex; hind femora on lower margin excised at apex; marginal vein much shorter than submarginal; postmarginal vein about half as long as marginal; stigma knob not subsessile, the stigmal vein almost as long as postmarginal; eyes hairy.

Type of the genus: *Idiomacromerus bimaculipennis* Crawford.

Idiomacromerus bimaculipennis n. sp.

Female: Length about 3.5 mm.; ovipositor 1.75 mm. Brilliant coppery

[redacted]

the scape and pedicel testaceous; first ring joint subquadrate, second transverse; funiclar joints subquadrate; propodeum basally with short rugæ so the base appears as if with a row of pits; wings hyaline, with an irregular ovoid fumated spot at base of marginal vein and a fumation at postmarginal vein, this extending almost half way across wing and, turning centrad extends with decreasing intensity as far centrad as the base of the other spot, there being a narrow subhyaline space between them; legs coppery with the tips of femora, the tibiæ and tarsi, entirely testaceous.

One specimen labelled "23.6" (June 23). Type specimen Cat. No. 18168 U. S. N. M. Type locality: American Fork Canyon, Utah.

ANTISTROPHOPLEX new genus.

Eyes bare; marginal vein short, the stigmal knob almost subsessile, postmarginal vein about half as long as marginal; hind tibial spurs rather short, the longer not half as long as the first joint of the tarsi.

Type: Antistrophoplex bicoloripes Crawford.

Antistrophoplex bicoloripes n. sp.

Female: Length about 3 mm.; ovipositor about 2.5 mm. Head and thorax bronzy-green, finely rugoso-punctate, antennæ brown, the scape reddish-testaceous, the pedicel greenish with the apex testaceous; pedicel longer than the first joint of the funicle, the funiclar joints subquadrate; propodeum faintly reticulately aciculate; wings hyaline, marginal vein short, the postmarginal vein almost as long as the marginal, the stigmal shorter than postmarginal; coxæ and about the basal half of all femora greenish, apical half of femora and all of tibiæ reddish-testaceous; tarsi more whitish; abdomen greenish, dorsally and basally brown with a greenish reflection.

Type locality: Garden City, Kansas. Bred from galls of *Antistrophus* species. Type-specimen, Cat. No. 18169 U. S. N. M.

Described from six females received from the Bureau of Entomology, U. S. Department of Agriculture, under Chittenden No. 84, with the additional record, "bred from galls on a composite, collected September 14, 1913, by C. H. Popenoe."

ZAGLYPTONOTUS new genus.

Marginal vein about two-thirds as long as submarginal, stigmal knob subsessile; postmarginal short, hardly one-third as long as marginal; posterior tarsi about one-third longer than hind tibiæ, the first tarsal joint not quite as long as 2–5 combined; hind tibial spurs long, the longer as long as the first joint of the tarsus; hind femora with a minute tooth on lower margin near apex and excised beyond this.

Type: Zaglyptonotus schwarzi Crawford.

Zaglyptonotus schwarzi new species.

Female: Length about 3 mm.; ovipositor about 3.5 mm. Green with a brassy tinge; antennæ brown, the scape and pedicel green; vertex and dorsum of mesothorax rugoso-punctate on front of mesoscutum and parasidal areas the sculpture aciculate in somewhat diamond shapes as in many species of *Monodontomerus;* wings hyaline; legs green, the tibiæ brown, with only a slight greenish tinge, the tarsi testaceous.

Type locality: San Diego, Texas. Type specimen, Cat. No. 18178 U. S. N. M. Described from three females labelled "24.4" (April 24) E. A. Schwarz, collector.

DESCRIPTIONS OF TWO NEW SPECIES OF STREPSIPTERA PARASITIC ON SUGAR CANE INSECTS.

By W. Dwight Pierce, *Bureau of Entomology.*

Although the order Strepsiptera is composed entirely of parasitic insects, the majority of the species of which the hosts are known attack insects of no great economic importance. For a number of years the entomologists of Hawaii sought in various parts of the world parasites of the sugar cane leaf hoppers, including the Strepsiptera in their searches. They brought to light several interesting species, parasitic on different leaf hoppers (Homoptera).

I am now able to describe two additional species of Halictophagidæ important as enemies of sugar cane leaf hoppers from the two hemispheres. One was obtained in very large numbers by Mr. Thomas H. Jones of Porto Rico at Rio Piedras, as a parasite of the destructive *Stenocranus saccharivorus* Westwood, the other was found by Mr. C. S. Misra, at Pusa, India, as a parasite of the sugar cane fly of India, *Pyrilla* sp. The sugar cane leaf hopper of Fiji, *Perkinsiela vitiensis* Kirkaldy has already been recorded as commonly parasitized by an Elenchid, *Elenchoides perkinsi* Pierce.

The genus *Stenocranus* belongs to the Fulgorid family Delphacidæ, and the genus *Pyrilla* belongs to the Fulgorid family Lophopidæ.

Family **Halictophagidae.**

Subfamily ANTHERICOMMINAE.

Stenocranophilus new genus.

Male: Head excavated behind, seen from above consisting of a narrow arcuate rim supporting the eyes and produced considerably in front of these

to form the tip of the sulcate frontal projection, at the sides of which the antennæ are inserted. Eyes very large, convex, reaching and touching the base of the elytra. Mandibles very short, broad and blunt, not reaching within their own length of each other. Maxillæ a little longer, two jointed, cylindrical, the first joint almost twice as thick as the second, and neither quite as long as the mandibles. Antennæ elongate, seven jointed, flattened foliaceous, with large sensory pits; first two joints simple, third to sixth moderately elongate, each produced just before the attachment of the succeeding joint into a broad flattened lamina not much more than twice as long as the main stem; seventh joint also produced, laminate. Pronotum subquadrate, cut off at sides by head. Mesonotum band-like, also included within the cavity of the head. Elytra elongate. Metanotum with præscutum elongate, convex at base, sides roundingly approximate toward apex, where they almost meet; scuti narrow, elongate, only a little longer than præscutum; scutellum broad, quadrate, basally convex, apically bisinuate, not much longer than postlumbium; postlumbium at least two-thirds as long as wide; postscutellum long, broad; femoralia reaching to middle of postscutellum. Wings with radial vein meeting the costal margin beyond the middle, a small detached cloudy vein behind the tip of the radius, medius strong, with a long anterior cloudy branch, cubitus missing, first anal merely a cloudy vein, second anal strong, third anal missing. Tarsi three-jointed, the first joint of different shape from the following; claws absent. Œdeagus strongly bent; the under side being twice bent and the upper thrice; the last bend being a very strong reflexion at apical fourth; apex very acute.

The generic name is derived from *Stenocranus* (the host genus) + φίλος (loving), signifying a parasite of *Stenocranus*.

Type of genus, *quadratus* n. sp.

Stenocranophilus quadratus new species.

Described from one type and five paratype males bred by T. H. Jones, October 19, 1912 from two female and four nymphal *Stenocranus saccharivorus* Westwood collected October 14, and 16, 1912 from sugarcane at Rio Piedras, Porto Rico, and bearing the Porto Rico Sugar Planter's Association accession number "847-1912." One paratype was returned to the association. The specific name is intended to draw attention to the quadrate form of the pronotum and the scutellum. This form of scutellum has not heretofore been found in the Halictophagidæ.

Male: Length 0.9 mm., wing expanse 2 mm. Color golden brown. Very few points not mentioned in the generic description remain to be noted. The first tarsal joint is broad, apically broadest and somewhat acute on outer angle, the point of attachment of the second is subapical at the inner angle; the point of attachment on the second joint is dorsal and very near

its base, this joint and the third are both slender at base, gradually enlarged, pulvillate beneath, apically truncate. The antennæ are quite long, the stem portions of the joints being longer than usual. The last joint reaches as far back as the scutellum. The length of the præscutum and scutellum about equals that of the postlumbium and postscutellum.

Female: Cephalothorax about 0.2 mm. long, golden yellow, not much darker behind the opening of the brood canal; almost one quarter longer than wide; sides constricted at base, parallel at middle, angulate and convergent from anterior third, sinuate at apex. Mandibles large, obtuse with outer edges marginal; front convex extending beyond mandibles and separating them by a little more than their width. Opening of brood canal broad, trapezoidal. Spiracles ventral, close to margin.

Type, four paratype males, and allotype female in U. S. Nat. Mus., Cat. No. 18813.

Subfamily HALICTOPHAGINAE.

Pyrilloxenos new genus.

Male: Head not conspicuously excavated behind. Eyes large, convex with very large facets. Mandibles short, triangular, glabrous. Antennæ short, seven-jointed, flattened foliaceous, with large sensory pits; first two joints simple, the second shorter; the remaining five joints crowded, each broadened laterally in a broad lamina, the apices of which are about even with each other, the entire antennæ not longer than width of head.

Pronotum very short, transverse bandlike. Mesonotum a little longer, also bandlike. Elytra pedunculate, spatulate, sensitive, pubescent. Metanotum with præscutum rounded, keystone-shape, truncate, sinuate at apex, longer than scutellum and postlumbium together; scuti oblique, considerably surpassing præscutum at outer angles and supporting it by a tiny projection at inner angles; scutellum broad, irregular in outline, narrower at base than præscutum, broadening in a concave line behind scuti, with anterior angles rounded, almost rectangular, and posterior angles diagonally produced as quadrate peduncles, apex otherwise truncate; postlumbium short, transverse, fitting in between and scarcely surpassing the posterior peduncles of the scutellum; postscutellum large, convex, broadly rounded.

Tarsi three-jointed, the first joint mucronate; claws absent. Eighth ventral segment acutely produced beneath ninth. Anal segment small, flaplike. Œdeagus strongly bent, broad near base, rectangularly bent near apex, apical process slender and very acute.

The generic name is derived from *Pyrilla* (the host genus) + *Xenos* (the typical Strepsipterous genus), signifying a Strepsipterous parasite of *Pyrilla*.

Type of genus, *compactus* n. sp.

Pyrilloxenos compactus new species.

Described from a type female, and allotype male, and two paratype females from Pusa, Behar, India, collected by C. S. Misra.

The material was collected in August, 1907, March 15, 1913 and May 23, 1914. The host is an undetermined species of *Pyrilla*. The specimens collected in August, 1907 consist of allotype male, male pupa cephalotheca, and three paratype females with triungulinids. This material is the property of the Entomological Section, Agricultural Research Institute, Pusa. The type is deposited in the United States National Museum, and a paratype female is in the author's collection. The author is indebted to Mr. T. Bainbridge Fletcher, Imperial Entomologist, for the material. The specific name is intended to draw attention to the compact appearance of the antennæ.

Male: Length 1.5 mm. The tarsi are very small. The anterior tibiæ are very robust and shorter than on the other legs. The antennæ are much more compact than is usual in this family. The mandibles can not meet. The remainder of the description is to be drawn from the generic description. The specimen was unfortunately boiled in caustic potash and is therefore very hard to study.

Female: Cephalothorax, golden yellow to brownish, broader than long; constricted behind spiracles; sides quite evenly rounded; apex sinuate. Mandibles obtuse, separated by almost three times their width. Front convex. Spiracles just touching margin.

Type in U. S. Nat. Mus.—Cat. No. 18814.

A NEW TACHINID PARASITE OF DIAPHEROMERA FEMORATA SAY.

By W. R. Walton, *Bureau of Entomology.*

Two species of Tachinidæ parasitic upon the Phasmidæ are at present known to science. The first species was described by Pantel[1] in 1898 as having been reared from *Leptynia hispanica* Bal. in Europe. The second has been recently described by Mr. C. H. T. Townsend[2] reared by the brothers Severin from *Diapheromera femorata* Say. in Wisconsin. A third parasite of this same host is herewith described. It is generically closely related to *Hallidaya* Egger, but is apparently distinct because of the position of the antennæ above the center of the eye and of the greater

[1] La Cellule XV-290.
[2] Annals Ent. Soc. Am. Vol. II, p. 243.

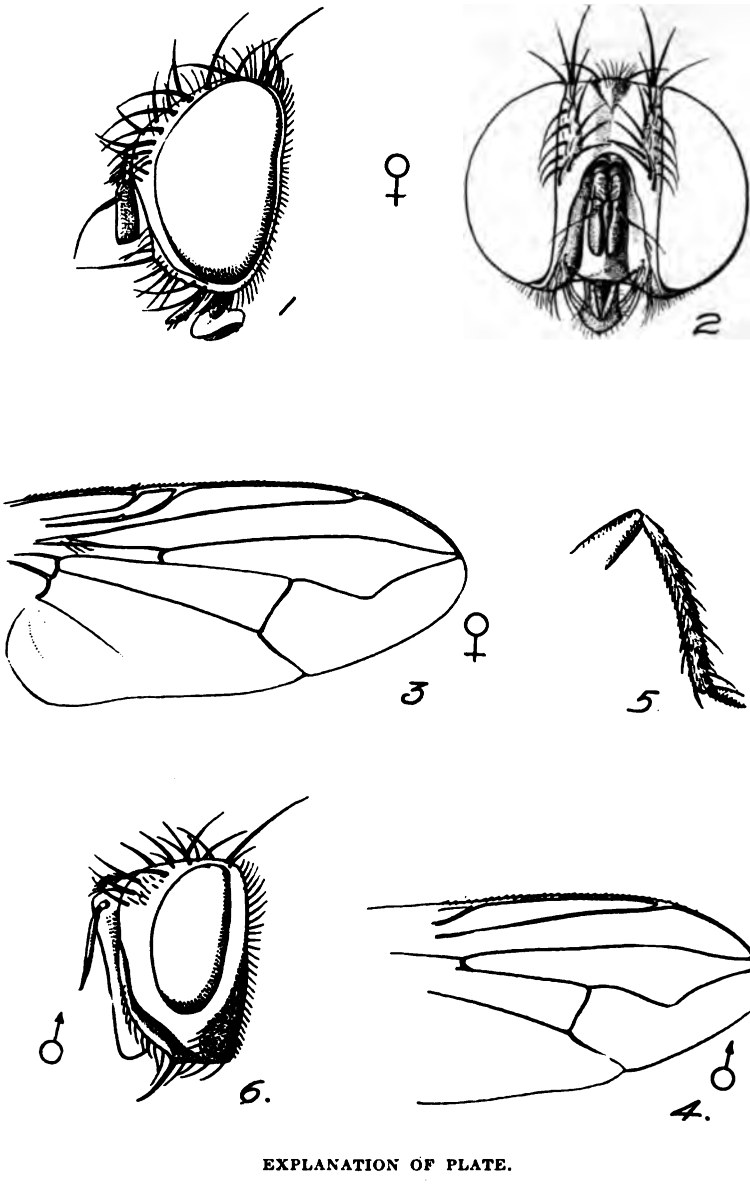
length of the same in *Euhallidaya*. It seems remarkable that the three known parasites of the Phasmidæ should prove to be widely separated generically.

EUHALLIDAYA new genus.

Palpi present, well developed, proboscis short, fleshy. First longitudinal vein bare, sides of face on lower half bare. Apical cell ending close to wing tip, fourth vein without trace of appendage at its bend, beyond bend curving distinctly inward. Second aristal joint about as long as broad. Arista incrassated on its basal third, eyes bare. Lowest frontal bristles about opposite apex of second antennal joint. Ocellar bristles present pointing obliquely forward. Posterior orbit and occiput linear, cheeks nearly so, bearing on the lower edge a row of strong bristles pointing obliquely forward. Orbital bristles in both sexes consisting of six or more pairs of strong, proclinate, curved macrochætæ reaching nearly to the apex of second antennal joint. Lowest frontal bristles nearly perpendicular to front, upper frontals curving backward. Anterior claws short in both sexes. Type *Euhallidaya severinii* n. sp.

Euhallidaya severinii new species.

Length 4 mm., brownish, compact, wings hyaline. *Female:* Frontal vitta opaque dark brown, scarcely distinguishable from parafrontals, occupying two thirds width of front. Parafrontals slightly silvery pollinose, more apparent near base of antennæ. Ocellar triangle somewhat shining, ocellar bristles strong, placed slightly in advance of anterior ocellus being about as far removed therefrom as it is from the posterior ocelli. Parafacials fuscous, slightly gray pollinose. Antennæ blackish, thinly pollinose, third joint a little more than twice as long as second, sides straight nearly parallel, anterior apical corner right angled, posterior corner gently rounded. Palpi and proboscis clear, yellowish. Occiput, viewed from side, linear, thinly clothed with black hairs. Dorsum of thorax thinly silvery pollinose, more pronounced anterior to suture. Four dorsal vittæ, wide, indistinct posterior to suture. Dorso-central bristles three, sterno-pleurals three. Scutellum dark brown, thinly pollinose, marginal macrochætæ long, in three pairs, apicals vestigial. Discals irregular in number and position. Abdomen ovate, black, pseudomaculate on bases of second, third and fourth segments, pollen bordering spots and on lateral margins of segments silvery, remainder of pollen brownish. Posterior margins of segments black, shining, marginal macrochætæ borne somewhat before posterior edge of all segments. No true discal macrochætæ present. Abdomen clothed with coarse, black, reclinate hairs. Calypters yellowish. Wings hyaline. A line of three bristles at base of third vein. First posterior cell barely closed in margin of wing. Legs black, middle tibiæ bearing a single stout macrochæta, on the front side near the middle. Hind tibiæ, subciliate on post-exterior edge.



EXPLANATION OF PLATE.

Fig. 1. *Euhallidaya severinii*, head of female, lateral view.
Fig. 2. Head of female, front view.
Fig. 3. Wing of female.
Fig. 4. Wing of male.
Fig. 5. Right hind tibia.
Fig. 6. *Phasmophaga antennalis*, head of male.

Male: Very similar to female differing as follows: Front distinctly narrower, third joint of antennæ slightly shorter, about twice the length of second and slightly rounded on front apical corner. Several pairs of short bristles borne below true vibrissæ at lower edge of oral margin. Apical cell widely open in margin and bend of fourth vein consequently nearer posterior margin of wing.

Described from two specimens male and female reared from the common walking stick *Diapheromera femorata* Say by H. H. Severin, Milwaukee, Wisconsin, 1912, in honor of whom the species is named.

Type: A female deposited in the U. S. National Museum, Washington, D. C.

THE EARLY STAGES OF METRIOCNEMUS LUNDBECKI JOHANNSEN.

By J. R. Malloch, *Urbana, Illinois.*

The genus *Metriocnemus* of the Chironominæ is represented in the North American fauna by 11 species which with one exception are undescribed in either larval or pupal stages. The only previously described species, *M. knabi* Coquillett, has been taken in the larva stage in flowers of *Sarracenia*. It is represented in the collection of the Illinois State Laboratory of Natural History by a number of larvæ from Wisconsin. A drawing of the labial plate of this species is given herewith, fig. 9, to indicate the distinctions between it and that of *lundbecki* and also to correct some slight errors in the original figure.

The genus *Metriocnemus* may be distinguished from all other Chironomidæ by its possession of the following characters: Antennæ of male 2–13 jointed, of female 2–6; palpi, 4 jointed; proboscis poorly developed. Thorax projecting anteriorly, the head half hidden under its anterior portion; no strong thoracic bristles. Hypopygium without well developed superior and inferior processes in the male, the apical portion of lateral arm generally slipper-shaped, recurved. Fore tarsus with tarsal joint shorter than fore tibia; empodium present; claws of males generally digitate apically, of female simple. Wings without the medio-cubital cross vein; surface hairs distinct.

This paper is published by permission of Dr. S. A. Forbes, State Entomologist of Illinois.

Metriocnemus lundbecki Johannsen.

Chironomus nanus Lundbeck (*nec* Meigen), Vidensk. Meddel., 1898,

Metriocnemus lundbecki Johannsen, Bull. 85, N. Y. State Mus., 1895, p. 302.

Larva: Length, 4–5 mm. Yellow, or buff-colored. Head deep yellow, slightly longer than broad, tapering slightly on anterior half; antenna rather slender, its entire length about equal to one-half the width of head (fig. 1); mandibles stout (fig. 2), heavily chitinized, yellow at base, becoming gradually darker towards middle, the apical half, including all the teeth, almost black, 4 weaker, rounded, almost equal-sized teeth along inner margin; two long and rather strong hairs at base of mandible on ventral surface; two slightly weaker hairs on under surface of mandible near middle; lateral arm of epipharynx long, ending in three or four incurved teeth; labium with its anterior half blackened, marginal teeth as in fig. 3; two long hairs situated near to eye spots. Anterior pseudopods armed at apices with weak hairs; a weak lateral hair on each of the thoracic segments; posterior pseudopods with strong apical claws which have produced bases; no ventral respiratory organs on eleventh segment, the two dorsal pairs on twelfth short; anal tuft consisting of six sensory hairs, the basal process about twice as long as its diameter.

Pupa: Length, 3 mm. Greenish yellow. Frontal tubercles indistinguishable; 2–3 hairs on the anterior margin of thorax on each side; respiratory organs shaped as in fig. 4; anterior to and in line with these organs are four hairs, a pair on each side; abdominal segments, except segment one, covered on the dorsum with very minute stout setæ which become much stronger posteriorly and form a distinct comblike transverse row on the posterior margin of each segment, as indicated in fig. 5; the membranous portion of segment between the setulose margin and apex of the succeeding segment presents a distinctly reticulated or honeycombed appearance, the intersecting lines clear, the central portions fuscous; ventral segments very similar to those of the dorsum; anal appendages as in fig. 5.

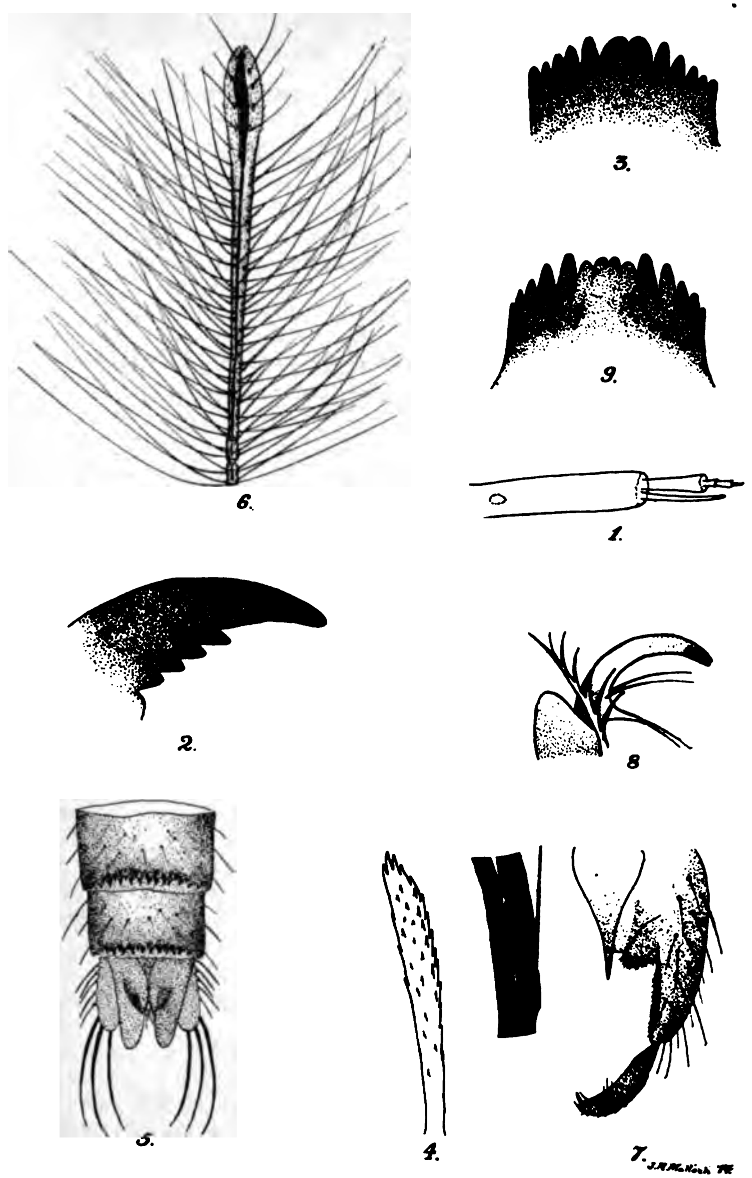
Male: Yellow, slightly shining; mesonotum trivittate, the central vitta divided longitudinally by a distinct yellow line, and posteriorly abbreviated, the lateral vittæ abbreviated anteriorly; color of vittæ reddish; pleuræ brownish on lower half; scutellum yellow; postnotum brown. Abdomen yellow, the apical 2–3 segments obscurely brownish. Legs yellow, the apices of tarsi slightly infuscated. Wings clear, veins yellow. Halteres yellow.

Antenna slightly longer than head and thorax together, last joint subequal in length to the remainder, distinctly cleft, as shown in fig. 6, the other joints of flagellum also cleft, but not so distinctly. Apical portion of lateral arm of hypopygium slipper-shaped, turned back on inner side of basal portion, its apex with a short thornlike bristle which is directed at right angles to the long axis of the arm (fig. 7). Fore metatarsus nearly three-fourths as long as fore tibia; no long hairs on tarsi, those on mid and hind legs barely longer than diameter of the joints upon which they are situated; fourth joint of fore tarsus one and a half times as long as fifth, fourth and fifth joints of mid and hind legs subequal; empodium present

(fig. 8), the claws of male distinctly divided at apices as shown in the figure, base sharply produced. Posterior branch of cubitus distinctly deflected near its apex, then running straight to margin of wing; posterior margin of wing with a distinct fringe, which is very long at anal angle but becomes gradually shorter as it nears the apex; the cubitus forks very slightly beyond the vertical line of the cross vein. Length, 2.5-3 mm.

Three larvæ of this species were taken March 16, 1914, in a small stream which enters Salt Fork near St. Joseph, Ill. They were placed in glasses containing water from the city supply, mixed with a little creek water in which they had been brought to the office. They were for some time unable to accustom themselves to the new conditions, there being evidently an excess of oxygen in the city water,[1] and, along with some larvæ of *Orthocladius nivoriundus* Fitch, they repeatedly came to the surface, where they remained partly above the water film. I considered that this coming to the surface was due to an abnormal buoyancy caused by the formation of air bubbles on parts of the bodies of the larvæ which made it impossible for them to remain below water. This was undoubtedly partly the reason, since whenever the body became coated with a number of the bubbles the specimen came to the surface without any apparent effort on its part, and seldom succeeded in diving below upon being touched, as they very readily do under normal circumstances. Even when the surplus oxygen was no longer visible in the form of bubbles the larvæ were restless and almost as often at the surface as beneath the water; but gradually they either became accustomed to the conditions or the conditions changed sufficiently to suit them, for they settled down in the mud and dead leaves which had been placed in the glasses. Here they formed burrows which they never left unless disturbed. They fed upon the decaying leaf tissue, generally, by protruding the anterior half of the body from either end of the burrow, evidently being able to turn around within it. Pupation took place within the burrow, but soon after the transformation the anterior half of the pupa was protruded, and thus remained until shortly before the emergence of the imago, when it was released entirely and, coming to the surface, after a few quick jerky motions the fly rapidly emerged. One specimen of *lundbecki* remained from Monday till Thursday morning in the larval stage, emerging from the pupa on Saturday morning. Emergence took place very quickly, occupying not more than three seconds. The other specimen which I succeeded in rearing was rather longer in the pupal stage, pupating on Friday and emerging on Monday morning. Both the specimens reared are

[1] This is, I believe, abnormal, as this water is generally deficient in oxygen.



EXPLANATION OF FIGURES.

Fig. 1. *Metriocnemus lundbecki*, antenna of larva.
Fig. 2. *Metriocnemus lundbecki*, mandible of larva.
Fig. 3. *Metriocnemus lundbecki*, labium of larva.
Fig. 4. *Metriocnemus lundbecki*, thoracic respiratory organ of pupa.
Fig. 5. *Metriocnemus lundbecki*, apical 3 segments of pupa.
Fig. 6. *Metriocnemus lundbecki*, apical 3 joints of antenna of male.
Fig. 7. *Metriocnemus lundbecki*, one side of hypopygium of male, dorsal view.
Fig. 8. *Metriocnemus lundbecki*, tarsal claw of male.
Fig. 9. *Metriocnemus knabi*, labial plate of larva.

males and are in the collection of the Illinois State Laboratory of Natural History under No. 45690, one mounted on card point, the other, with the cast larval and pupal skins, on a slide in Canada balsam. The larval skin of the dry-mounted specimen was not found, but the pupal skin is mounted on a separate slide under the above number.

A NEW SPECIES OF NORTH AMERICAN TINGITIDÆ.

By Otto Heidemann, *Bureau of Entomology.*

Gargaphia solani new species

Body rather flat, dark brown; the angulated, yellow rim of the rostral groove very distinct at base of metasternum. Head dark, deeply punctured; at the frontal part three small, slender spines, the upper one more prominent, two others near to the eyes a little longer. Antennæ quite long, hairy; basal joint comparatively thick, black and somewhat longer than the terminal joint, which is fusiform and black at the apex; second joint the shortest, testaceous; third more than four times as long as the fourth joint, yellowish-white; bucculæ moderately expanded, yellowish, with one row of minute areoles.

Fig. 1.

Pronotum feebly convex, black, with three low, yellowish carinæ, the median one a little higher before the middle, tapering toward the pale apex of the triangular, posterior portion of pronotum; the lateral membranous part of the pronotum angularly expanded, with two to five series of irregular areoles, the edge somewhat broadly reflexed, some of the nervures exteriorly blackish. Head, pronotum and the edge of the membra-

nous dilation densely covered with very fine, soft hairs; pronotal hood rather large, much longer than wide, covering the hind part of the head, leaving the eyes free; surface yellowish-white, opaque, with a few minute areoles. Hemelytra extending about one third beyond the abdomen; oblong-oval, broadly rounded at the end, feebly sinuate toward the base; the discoidal areas pyriform, reaching to about the middle of the elytra, reticulated, blackish at base and at apex, a pale stripe across the middle; the subcostal biseriate, yellow; costal margin yellowish-white, translucent, with four or five series of medium sized areoles at the widest part, those toward the base smaller; five transverse oblique nervures black at the costal area and all nervures at the apex more or less blackish. Legs pale, yellow. Length, 4 mm.; width, 2 mm.

Described from several specimens, males and females. Kirkwood, Mo., August 10 (Riley, Pergande) found on *Solanum carolinense* and *Solanum elæagnifolium;* Lavaca Co., Texas, June 21; Columbus, Texas, July 29, 1879 (Riley collection) on coffee weed and *Solanum;* El Reno, Okla., July 12, 1909; Norfolk, Va., June 12, 1914 (Fink). It is recorded as found on egg-plants and potatoes in great abundance.

Type: No. 18810 U. S. National Museum.

This new species resembles *Gargaphia angulata* Heid. in the general outline, but differs considerably by the larger size and by the prominence of the hood, being much longer. It belongs to a group of *Gargaphia* species which have the membranous dilation of the pronotum angularly expanded instead of roundly dilated, as in *G. tilia* Walsh; *G. patricia* Stal; *G. opacula* Uhler and others. Judging from the localities already known, this species seems to have a wide range of distribution, from the Atlantic coast to the Southwestern States.

FORCIPOMYIA PROPINQUUS WILLISTON, A CORRECTION.

By J. R. Malloch, *Urbana, Illinois.*

In a footnote in an article on Ceratopogoninæ ante p. 63 of these Proceedings it is stated that the figures of the tarsus and the wing of *Forcipomyia propinquus* given by Williston are those of the female and not the male. I considered that the statement was an error because the single specimen described by Williston, in addition to being indicated as a male, is from the description obviously of that sex. The figure of the tarsus is also clearly that of a male, possibly of *eriophorus*, though the wing is drawn too blunt and short. The description of *eriophorus* is that of the female, an error being made in the insertion of the sex symbol.

I have received, in reply to an inquiry, a letter from E. E. Austen who has charge of the collections in the British Museum, and who is qualified to give authentic information, stating that the above facts as to type are correct.

NEOCELATORIA FEROX WALTON A SYNONYM OF CHAETOPHLEPS SETOSA COQ.

By W. R. Walton, *Bureau of Entomology*.

I am indebted to Dr. J. M. Aldrich for calling my attention to the probability of the above mentioned synonymy. A comparison of the types shows them to be identical. Mr. Coquillett did not describe the peculiar armature of the female abdomen in his original description of the genus or species.

A NEW ORTALID FLY.

By Nathan Banks, *Bureau of Entomology*.

Pseudotephritis appoximata new species.

Similar to *P. vau* Say, but larger and marks on the wings different. Head and thorax marked as in *P. vau*, the same large brown spots, but on thorax the minute brown marks are rather more numerous. On abdomen the third segment is mostly pale, with only minute dark spots, the following segments wholly dark; legs marked as in *P. vau*. In wings the marks on costa and at tip are black, the others fainter, more yellowish brown; the clouds over cross-veins not connected, that over posterior cross-vein extending toward the cloud below preapical costal spot; and that over the discal cross-vein extending to the middle costal spot, the outer margin of the broad sub-basal cloud is much interrupted at the fourth vein. The posterior cross-vein is as near the outer margin as to the anterior cross-vein. The macrochætæ of head and thorax are as in *P. vau*. Length, 7.5 mm.

From Falls Church, Virginia, July 15.

NOTE ON A CLASSIFICATION OF SEXUAL CHARACTERS.

By Charles H. T. Townsend.

Sexual characters have long been distinguished as either primary or secondary. The writer believes that the so-called "secondary sexual characters" may profitably be classed as *secondary* and

tertiary, and hereby proposes these terms with definitions of the three resulting classes.

Primary sexual characters are those which relate to the true organs of generation—the internal reproductive system and the external genitals.

Secondary sexual characters are those which relate to the external structures immediately accessory to the true organs of generation. They include in the muscoid flies the hypopygium of both sexes in its widest sense, being such structures as the ovipositor, piercer, ventral carina, hypopygial clasping organs—all extra-primary structures directly functional in copulation, oviposition and larviposition, or specially designed for the reception of such structures during rest.

Tertiary sexual characters include all others that are ever distinctive of sex and may be defined as those which pertain to structures not directly functional in either copulation, oviposition or larviposition, nor adapted for reception of organs directly concerned in these functions. For example, the elongated claws of certain male flies are indirectly functional in copulation, but so are the legs and the whole body for that matter. Neither is to be considered as immediately accessory to the true organs of generation.

The mass of sexual characters in the muscoid flies are to be classed as tertiary. A great number of external anatomical structures are here involved, representing nearly all parts of the body. The tertiary sexual characters are not at all uniform as to the structures that they affect, but vary greatly in different groups of these flies. A detailed enumeration of them is already in manuscript, and will be published in due time.

CERATOPOGONINÆ SUCKING THE BLOOD OF OTHER INSECTS.

By Frederick Knab, *Bureau of Entomology.*

In discussing Ceratopogoninæ as enemies of other insects in a recent number of this journal,[1] observations by two different authors were cited of these midges sucking the body-fluids of *Anopheles* mosquitoes. I find that I overloooked a third note on this subject by Dr. A. T. Stanton, which calls attention to an earlier record by Capt. C. J. Fearnside and adds observations made by himself in the Malay Peninsula.[2]

[1] Ceratopogoninae sucking the blood of caterpillars. Proc. Ent. Soc. Wash., vol. 16, p. 63–66, 1914.

[2] A Ceratopogon parasitic upon anopheline mosquitos. Paludism, no. 5, p. 64, 1912.

Captain Fearnside gives a figure of one of the flies observed attacking mosquitoes and this shows that the insect belongs to the genus *Culicoides*. In this case the midges were found attached to common house mosquitoes, presumably *Culex quinquefasciatus* (= *fatigans*).

> If blood-fed mosquitos (i.e., culex) are collected from the dark corners of rooms, godowns, &c., one occasionally meets with a small fly fixed to the undersurface of the abdomen of the host . . . . When it has fed, there is an oval brown mass in the centre which is decomposed blood extracted from the mosquito's stomach.[1]

Dr. Stanton's observation is as follows:

> During the past year I have been engaged in the examination of anopheline mosquitos taken in the Pudoh Gaol, Kuala Lumpur. On six occasions I have found a species of Ceratopogon with its proboscis, as shown in the specimen, deeply embedded in the abdomen of female anophelines which had previously fed on blood, presumably that of prisoners. The anophelines were of the following species *N. fuliginosus*, *N. karwari* and *M. sinensis*. The flies were in every case attached to the under surface of the abdomen, generally about the fourth or fifth segment. Twice the anopheline carried two specimens of the fly. In every case the stomach of the Ceratopogon contained blood.

Recently the writer has examined a preparation sent by Mr. A. Rutherford of Paradeniya, Ceylon, in which there is a specimen of *Culicoides* attached to a female *Anopheles*. In this case the midge has its proboscis inserted in the anterior thoracic region of the mosquito, just above the fore coxæ, and there is nothing to indicate that it might have been extracting the contents of the mosquito's digestive tract. The reference given in my previous article, on p. 64, for F. H. Gravely's note is incorrect; the article appeared in vol. 6, p. 45, of the Records of the Indian Museum.

It appears that the statement made by myself on p. 65, that blood is absent from the wings of mature Lepidoptera, is erroneous. In this I was only sharing a common impression that there is no circulation in the hardened wings of most insects. I need hardly add that I was perfectly familiar with the more obvious cases, such as certain Coleoptera, in which there is a plain and abundant circulation during life. The question has been very ably discussed recently by Mr. R. Bervoets and his careful investigations have resulted in the demonstration of an active circulation in the wings

[1] Parasites found on mosquitos. Indian Med. Gazette, vol. 35, p. 129-130, 1900.

of representatives of the more important orders of insects.[1] Regarding the Lepidoptera, he gives the following observation.

The hind wing of a pierid, examined with a hand lens, shows all its veins filled with a pale green liquid; if one sections this wing, one sees this liquid issue in abundance, above all if one exercises a gentle pressure.

It follows, then, that the *Ceratopogon* observed by Mr. Kryger could have obtained blood from the wings of the moth in any case and that it was quite unnecessary to assume that the latter was immature.

DESCRIPTIONS OF TWO PARASITIC HYMENOPTERA.[2]

By S. A. Rohwer, *Bureau of Entomology.*

Sympherta mnemonicæ n. sp.

This species is readily distinguished from the other species which have been referred to the genus, by the color. It differs from the genus according to the characters given in the generic tables by the shorter tergites.

Female: Length 3 mm.; length of antennæ 2.5 mm. The anterior margin of the clypeus truncate, ventrally convex, front finely granular and with a number of widely separated, distinct punctures; area immediately below the antennæ slightly convex, vertex and occiput sculptured like the face; intra-ocellar area slightly raised, the surface without any punctures, with fine granulations and parted posteriorly by a median furrow; antennæ 28-jointed, the third joint sub-equal with the fourth; mesoscutum rather coarsely granular posteriorly, anteriorly more finely granular and with separate punctures; scutellum more finely sculptured than the scutum; dorsal aspect of the propodeum similar to the scutellum, with a median triangular areola which is petiolate; posterior face completely areolated; mesepisternum except the shining foveæ and middle dorsal margin, finely granular; first tergite with a short petiole broadening beyond the spiracles, it and the second with coarse granulations; second tergite decidedly wider than long; relative width and length of the tergites becomes greater posteriorly; third and following tergites shining, finely coriaceous; nervellus broken decidedly below the middle. Black; anterior margin of the clypeus, mandibles except the piceous apices, scape and most of the flagellar joints beneath, tegulæ and legs *testaceous* or *rufo-testaceous*; wings hyaline, iridescent, venation dark brown; costa tetaceous.

---

[1] Notes sur la circulation du sang dans les ailes des insectes. Ann. Soc. Ent. Belg., vol. 57, p. 184–190, 1913.

[2] Contribution from the Branch of Forest Insects. Bur. of Ent., U. S. Dept. of Agric.

Male: Length 4 mm. Antennæ 26-jointed. Differs from the female in having the face below the antennæ, the inner margins of the eyes to the level of the anterior ocellus, cheeks, two spots on the scutum, small lateral spot on the first and third tergites, *yellow*; the third antennal joint is slightly shorter than the fourth.

Falls Church, Virginia. Described from three females, one type, and one male, allotype, recorded under Bureau of Entomology Number Hopk. U. S. 11133*e* and *f*, which refer to notes stating that these are primary parasites on *Mnemonica auricyanea* Walsingham, feeding on chestnut and oak. Material collected and reared (March 7, 1914) by Carl Heinrich.

Type: Cat. No. 18316, U. S. N. M.

The material was collected in the larval condition and kept in the rearing cages so oviposition must occur within the feeding larva, or the egg.

The parasite is referred to the genus *Sympherta* but the type of this genus is not available for comparison, and it is not unlikely that when the genera belonging to this group are more properly classified the above new species will be referred to a new genus.

Podogaster evetrivorus n. sp.

Female: Length 7.5 mm. Head below the antennæ shining, with only setigerous punctures, above the antennæ shining, but with distinct well defined, well separated punctures; postocellar line twice as long as the ocellocular line; occiput deeply emarginate, strongly margined; mesoscutum with distinct, well defined punctures which in the region of the notauli become confluent; in the posterior middle the punctures are closer; scutellum sculptured similarly to the scutum; propodeum with a median row of hexagonal foveæ which become smaller posteriorly, laterally coarsely reticulate; abdomen shining, impunctate. Black; head below the antennæ and the orbits to the vertex, posterior orbits broadly, scape beneath, dorsal posterior angles of the pronotum, tegulæ, four anterior legs (femora and tibiæ reddish) *yellow*; abdomen piceous and the third and fourth segments rufous; posterior legs black with the base of the tibiæ and the second trochanter yellow; wings hyaline, venation dark brown.

Male: Length 8 mm. Agrees with the above characters of the female.

Fort Bayard, New Mexico. Described from one female, type, one male allotype and three female paratypes recorded under Bureau of Entomology Number Hopk. U. S. 12101*c* which refers to a note stating that this is a parasite of *Evetria* species working in *Pinus ponderosa*, material reared by Carl Heinrich, adults emerging November and December.

Type: Cat. No. 18997, U. S. N. M.

Actual date of publication, September 26, 1914.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVI | 1914 | No. 4

DESCRIPTIONS OF NEW MICROLEPIDOPTERA OF FOREST TREES.[1]

(With Plates VII and VIII)

BY AUGUST BUSCK, *Bureau of Entomology*.

Sesia brunneri n. sp.

Labial palpi orange red with a broad black lateral streak exteriorly. Face dark metallic blue. Head deep black. Antennæ bluish black. Collar metallic blue. Thorax bluish black with the anterior sides sprinkled with red and with patagia dark orange red. Forewings alike in both sexes, transparent with broad purplish blue edges and a broad, perpendicular streak at the end of the cell; extreme costal edge narrowly orange; underside of the apical and especially of the costal edging sprinkled with orange red. Hindwings transparent, with narrow blackish blue edges and veins; costal edge dusted with red, especially on the underside. Abdomen dark metallic blue with distinct, red, transverse streaks on second and on fourth segments and sometimes with traces of red also between the other segments. Anal tuft with dark metallic blue center, edged with brick red; under side red. Legs dark metallic blue, liberally sprinkled and banded with red; tarsi blue. Alar expanse: male, 24–25 mm.; female, 26–27 mm.

Foodplant: *Pinus ponderosa.*

Habitat: Camas, Montana, Josef Brunner, collector.

Type: Cat. No. 18238, U. S. N. M.

This species is named in honor of Mr. Brunner whose observations of the life history enabled the differentiation of this species from the very similar *Sesia novaræensis* Hy. Edw., which lives in Douglas fir.

This species differs from the somewhat more robust *Sesia novaræensis* in the blue, not black, ground color and in the much less extensive red abdominal coloration.

[1] Presented at meeting of April 2, 1914.

Sesia piceæ Dyar, a third species of this group may be differentiated by the entirely black abdomen.

Recurvaria milleri n. sp.

Labial palpi white, second joint with two black bars externally; terminal joint with an incomplete black annulation at base. Antennæ white annulated with black. Face white. Head white sparsely sprinkled with dark fuscous. Thorax white strongly suffused with dark fuscous. Forewings white, strongly and irregularly suffused with black, especially on costal and apical parts; a large, poorly defined, black spot on costa beyond the middle and a smaller one just before the middle; opposite the former is an even less well defined dorsal black spot; four small tufts of raised black scales, one on the middle of the cell, one at the end of the cell and two below these on the fold; scattered black dots around apical edge; all of the black markings are fugitive and easily lost in flown specimens. Cilia ochreous white, dusted with black. Hindwings whitish fuscous; cilia slightly ochreous. Abdomen silvery white with a large, bluish black poorly defined spot on the upper side and shaded with black on the under side; the males have a large, conspicuous, ochreous hair pencil on thorax underneath the base of the hindwings. Legs white, barred and annulated with black. Alar expanse: 12–15 mm.

Habitat: Yosemite National Park, California, John M. Miller, collector.

Foodplant: *Pinus murrayana.*

Type: Cat. No. 18438, U. S. N. M.

The species is named in honor of the collector. The larva is a needle miner like that of *Recurvaria pinella* Busck, in Colorado, and that of *Paralechia pinifoliella* Chambers, in the East.

Mr. Miller found this species exceedingly abundant, in the larval state, on June 26. From a shipment of needles from him, received on July 16, about a hundred moths issued en route and many more the following days.

Evetria bushnelli n. sp.

Labial palpi whitish dusted with fuscous; terminal joint fuscous. Face and head white, strongly mottled with fuscous, each scale being white at base and tip, with a dark fuscous median part. Antennæ white, irregularly annulated with dark brown. Thorax light gray, mottled with white and fuscous; base of patagia light reddish brown. Forewing deep reddish brown graduating into light ochreous on outer two-thirds of dorsal part of the wing. A blunt, triangular, ochreous spur runs up into the costal darker color. Beyond the cell and on apical third of dorsum is a small round spot of the dark brown ground color. Entire basal third of the wing brown with a superimposed, poorly defined, transverse fascia of silvery iridescent scales. At basal third, terminating this basal area is a broad, straight, transverse fascia of silvery or hyaline scales. This fascia begins in the

costal edge in two, small, indistinct, geminate, white streaks. From two similar costal streaks just beyond the middle of the wing runs a narrow, outwardly angulated, fascia of shiny hyaline scales across the wing. At apical third is a similar, but nearly straight, transverse fascia. The two latter fasciæ contain on the middle of the wing a few black scales. Before the apex are two small, silvery, costal streaks and the terminal edge is rather broadly suffused with similar silvery scales. All of the silvery markings appear to be slightly raised. Cilia bluish white with two transverse, blackish lines. Hindwing light fuscous; cilia whitish with a fuscous basal line. Abdomen silvery fuscous. Legs silvery fuscous; tarsi with indistinct, blackish brown annulations. Alar expanse: 12–19 mm.

Habitat: Fort Bayard, New Mexico, G. E. Bushnell, collector.
Foodplant: *Pinus ponderosa* and other pines.
Type: Cat. No. 18439, U. S. N. M.

This species is named in honor of the collector, Colonel G. E. Bushnell, to whom is due credit for all the information we have on its biology.

The larvæ feed gregariously in the terminal twigs of *Pinus ponderosa* and other pines and appear to be severely injurious to these trees.

The full grown larva is 14 mm. long; body of a reddish yellow color; tubercles not distinguishable; hairs short, white. Head light yellowish brown with black eyespots; thoracic shield small, darker brown. Feet normal, abdominal feet small with a single, complete circlet of uniform hooks.

The moths from overwintering pupæ produce an early summer generation, the adults of which issue about July first.

The species, which may have been introduced into New Mexico with the trees, is very close to the eastern *Evetria frustrana* Comstock, but averages considerably larger and differs in the details of ornamentation, and in the character of its work. It is the same species which for several years has been excessively injurious to the pine plantations of the U. S. Forest Service at Halsey, Nebraska. (See Forestry Quarterly, Dec. 1910.)

Evetria virginiana n. sp.

Labial palpi, face and head light whitish yellow. Antennæ reddish white with a thin, longitudinal, black line anteriorly. Thorax reddish brown, with a central transverse band suffused with white scales and with the posterior tip and the tips of the patagia white. Forewings broad and ample, rich reddish brown with a number of irregular, pearly white, transverse, forked and anastomizing lines with violet sheen, which terminate in five small, geminate, white costal streaks. The narrow areas surrounded by these transverse lines are of a somewhat lighter yellowish brown. This is particularly the case with one on the middle of the wing and one near tor-

nus. Cilia whitish brown. Hindwing very light, nearly white, slightly suffused with brown, especially toward tip; cilia white. Abdomen light brown, each joint edged with white. Legs white, suffused with brown; anterior tibiæ reddish brown. Alar expanse: 23 mm.

Foodplant: *Pinus virginiana.*

Habitat: Falls Church, Virginia. Reared by Carl Heinrich.

Type: Cat. No. 19036, U. S. N. M.

A very distinct, large, broadwinged species, nearest to *E. comstockiana* Fernald, but larger, more simple in its pattern, with darker thorax and more whitish hindwings. The species feeds in the young branches of *Pinus virginiana* and makes a large globular pitch-nodule (pl. VII, fig. 1), from which the imago issues early in May.

Evetria taxifoliella n. sp.

Labial palpi brown, mottled with fuscous. Terminal joint blackish. Face, head and thorax black, liberally dusted with white. Forewings grayish brown, transversely striated with white and black atoms, at basal third there is a poorly defined, dark brown, black edged, zigzag band across the wing, followed by a light gray and white area. Through the middle of the wing from the base runs a poorly defined, brown streak, enlarged into an irregular blotch at the end of the cell. On the costal edge there is a series of blackish spots with white dusted intervals, at tornus an oval, white, black dusted spot, with a short perpendicular, black line in the center. Apical and terminal edge dark golden brown with a black line along the extreme edge before the dark fuscous cilia. Hindwing blackish fuscous. Abdomen dark fuscous. Legs fuscous; anterior tarsi annulated with black. Alar expanse: 13–14 mm.

Habitat: Missoula, Montana, Josef Brunner, collector.

Foodplant: *Pseudotsuga taxifolia.* Reared by Mr. Brunner from cones.

Type: Cat. No. 18440, U. S. N. M.

This species is nearest and very similar to *Evetria siskiyouana*, Kearfott, but is only about half the size of that form.

Evetria metallica n. sp.

Second joint of labial palpi dirty white sprinkled exteriorly with black; terminal joints blackish fuscous. Face, head, and thorax bluish fuscous irrorated with white, each scale being tipped with dirty white so as to produce a rather light gray effect. Forewing strongly overlaid with bluish metallic scales in many broad, transverse, wavy lines, the intervals between the metallic scaling is rich dark brown liberally sprinkled with black scales. The metallic lines on the outer half of the wing originate in small whitish geminate costal spots. Cilia dark blue, whitish at the base and with a dark basal line. Hind wing dark fuscous. Abdomen dark blue, each joint broadly tipped with silvery fuscous; anal tuft silvery with blue center.

Legs dark silvery fuscous; tarsal joints with narrow dirty white annulations. Alar expanse: 20 mm.

Habitat: Missoula, Montana, Josef Brunner, collector.

Type: Cat. No. 18443.

The following note is by Mr. Brunner: "Larvæ on yellow pine, *Pinus ponderosa*, on which it makes a pitch tube on tip branchlets. Pupated April second, imago issued May seventh."

Evetria montana n. sp.

Labial palpi dark fuscous mixed with reddish brown exteriorly. Face and head light reddish ochreous. Thorax dark fuscous; base of patagia reddish brown. Forewings dark fuscous; base, a broad, transverse fascia just before the middle of the wing, and a narrower fascia beyond the middle, irrorated with white, each scale being broadly white-tipped. Outer half of the wing overlaid with brown and brownish ochreous and violaceous scales, more intensely so towards the very oblique terminal edge. Cilia fuscous, tipped with red. Hindwings shiny dark fuscous with lighter cilia. Abdomen and legs dark fuscous; tarsal joints with narrow, lighter annulations. Alar expanse: 20 mm.

Habitat: Elliston, Montana, Josef Brunner, collector.

Foodplant: Pinus contorta.

Type: Cat. No. 18442, U. S. N. M.

The following note is by Mr. Brunner: "The larva is found in buds which would be the terminals the succeeding season if not infested and destroyed by this insect. Adult moth issued in captivity December 10, from larva collected July 29."

The species is nearest and very similar to *E. neomexicana* Dyar, which, however, differs in the more uniform coloration of both the basal and apical part of the wing, and by having a longitudinal black streak to the middle of the termen.

Evetria albicapitana n. sp.

Labial palpi ochreous white, second joint shaded externally with light reddish brown; terminal joint sprinkled with black. Face and head white. Antennæ gray with narrow black annulations. Thorax reddish gray with a reddish brown, transverse band and with brown posterior tip. Patagia light reddish brown. Forewing light reddish brown with sparse black dusting and with silvery metallic cross-lines. Extreme costal edge blackish with three small, geminate, white spots on basal half and with four similar white spots on outer half; from each of these geminate costal spots originates a broken, transverse, silvery line which runs in an irregular zigzag course across the wing, without, however, reaching the dorsal edge. The three basal lines run in an outwardly oblique direction and nearly unite on the fold; the fourth line is quite short and leaves a large circle at the end of the cell without metallic scales; the fifth silvery line is nearly transverse and straight with but a single small interruption. Three, small,

yellowish white dashes on the terminal edge. Cilia gray with a black basal line. Hindwing dark fuscous with whitish cilia. Abdomen dark fuscous, each joint edged with white. Male claspers very large, covered on the outside with whitish scales, on the inside with long light brown hairs. Legs silvery white with broad blue bars and annulations. Alar expanse: 16–19 mm.

Habitat: MacDowell, Saskatchewan, Canada, J. C. Blumer, collector; Boulder Junction, Wisconsin, S. A. Rohwer, collector.

Foodplant: Pinus divaricata.

Type: Cat. No. 18444, U. S. N. M.

The larvæ bore in the young branches and make small, round resin nodes about two-thirds of an inch in diameter, (pl. VII, fig. 2). When full-grown the larva is about one-half inch long, of reddish color with a light brown head and thoracic shield; tubercles small, shiny.

Imago issued in captivity at Falls Church, Virginia, in early March, undoubtedly considerably earlier than is the case in nature.

Swammerdamia castaneæ n. sp.

Labial palpi dark fuscous with base and extreme tip white. Face and head white. Antennæ dark fuscous annulated with white and with white basal joint. Thorax white, sometimes slightly dusted with fuscous and with posterior tip suffused with fuscous. Forewings dark fuscous with strong bluish sheen, irregularly sprinkled with white and black scales, the latter tending to form indistinct, interrupted rows of black dots; a blackish costal dash just above apex; apical edge and cilia strongly dark golden cupreous. Hindwings dark fuscous; cilia lighter ochreous fuscous. Abdomen dark fuscous with ochreous anal tuft. Legs fuscous, tarsi annulated with white. Alar expanse: 11–12 mm.

Habitat: East River, Connecticut, Chas. R. Ely, collector, and Charter Oak, Pennsylvania, W. S. Fisher, collector.

Foodplant: Castanea dentata.

Type: Cat. No. 18441, U. S. N. M.

The species is close to the European *S. pyrella* and was wrongly identified by the writer as that species from New Hampshire (Proc. Ent. Soc. Wash. XIII, p. 80, 1911), but is somewhat larger and at once distinguishable by the white thorax.

The following are Dr. Ely's notes, which he with his usual liberality has asked me to utilize:

"Larva green, 10 mm. long. Forms a very loose, open web, much like that of a spider, on the upper side of chestnut leaf. The larva appears to the naked eye to be marked by transverse bands of darker green by reason of the darker shade at the points of the segments. Each segment has an indistinct dorsal streak

darker than the ground color. The tubercles are very dark surrounded by pale yellowish. The first two tubercles on the side of each segment are in a line, thus giving the appearance of a narrow, broken, subdorsal band. The head is yellowish and the cervical shield is pale spotted with the same color as the abdominal tubercles. The first larva spun its cocoon by July 17. The cocoon is white, silky, spindle-shaped and is suspended within the web. The larva eats off the tip of the leaf under the web. Adults emerged August 6."

Ectœdemia heinrichi n. sp.

Face and head deep black; mouthparts yellowish; antennal eye-caps large, creamy white; remainder of the antennæ black with narrow yellow annulations. Thorax light yellow sprinkled with black scales. Forewings light ochreous profusely and irregularly sprinkled with blackish fuscous scales; there are two, faint, poorly defined transverse fasciæ on which the dark scaling is less pronounced, one at basal third and one at apical third. Apical cilia creamy white with a black basal line. Hindwing and underside of all wings dark steely fuscous; cilia yellowish. Abdomen dark yellowish fuscous, underside silvery. Legs golden yellow, posterior tibiæ with strong golden spines above. Alar expanse: 9–10 mm.

Habitat: Falls Church, Virginia.
Foodplant: *Quercus palustris.*
Type: Cat. No. 19039, U. S. N. M.

Named in honor of my friend and assistant Carl Heinrich, who has ascertained the life history of this interesting species, which makes a characteristic mine in the bark of young branches of *Quercus palustris*. The mine is a narrow linear track, winding closely upon itself in an oval spiral much like a compressed watch spring, and showing very plainly in the bark (fig. 4). Old work cracks and leaves the inner bark exposed. The work was found only in this species of oak and mostly in the young saplings, although a few mines were found on the outer branches of larger trees.

The larva is very similar to *Ectœdemia castanea* Busck, but rather larger and with more pronounced ventral processes. These larvæ become mature in late fall and were observed leaving their mines from October 24 to November 5; they fall to the ground and spin a small reddish brown, oval, flattened cocoon 2–2½ mm. broad and 3–4 mm. long; forced cocoons yielded moths in the latter part of March.

The imagoes are very near to *E. obrutella* Zeller, but with much darker dusting and with darker hindwings.

EXPLANATION OF PLATES.

PLATE VII. Fig. 1, pitch nodule on *Pinus virginiana* caused by *Evetria virginiana* Busck; fig. 2, pitch nodules on *Pinus divaricata* caused by *Evetria albicapitana* Busck.

PLATE VIII. Fig. 3, chestnut leaves injured by *Eucosma haracana* Kearfott; fig. 4, twigs of *Quercus palustris* showing spiral mines of *Ectœdemia heinrichi*, Busck.

LIFE HISTORY OF EUCOSMA HARACANA KEARFOTT.[1]

BY AUGUST BUSCK, *Bureau of Entomology.*

Protopteryx haracana Kearfott, Trans. Am. Ent. Soc. Phila., vol. 33, p. 44, 1907.

Protopteryx resoluta Meyrick, Ent. Mo. Mag., vol. 23, p. 34, 1912.

During May and early June many leaves of the chestnut in the vicinity of Washington, D. C., are found to be rolled inwards and downwards, as shown in the accompanying photograph, (pl. VIII, fig. 3). These very common and conspicuous rolls are produced by the larvæ of the above species, the life-history of which has hitherto been unknown.

The young larvæ of this species are yellowish white with jet black head and thoracic shield and with black thoracic feet; tubercles small and inconspicuous, hardly darker than the rest of the body and with short white hairs; prolegs normal with a complete circle of small hooks. The full grown larvæ have light yellow head with black eyespots, yellow thoracic shield and feet; length 14 mm. When full grown the larvæ leave the rolls and let themselves down to the ground, into which they burrow and make a tough, parchment-like oval cocoon, in which they remain as larvæ until late fall. In a warm room the moths began to issue early in February; outdoors under natural conditions issuance does not take place before April.

[1] Presented at meeting of April 2, 1914.

Fig. 2.

Fig. 1.

Fig. 3.

Fig. 4.

ON MNEMONICA AURICYANEA WALSINGHAM.[1]

(With Plates IX-XVI)

BY AUGUST BUSCK AND ADAM BÖVING, *Bureau of Entomology.*

Micropteryx auricyanea Walsingham, Trans. Am. Ent. Soc. Phila., p. 204, 1882.
Eriocrania auricyanea Walsingham, Entom. Record, London, x, p. 162, 1898.
Eriocephala auricyanea Dyar, List N. A. Lep. no. 6018, 1903.
Mnemonica auricyanea Meyrick, Genera Insectorum fasc. 132, p. 5, 1912.

The only published note on the biology of any American species of the superfamily Micropterygidoidea is by Wm. D. Kearfott (Entom. News, p. 129, 1902). He discovered the mine and the larva of what was presumably this species in the leaves of chestnut, and obtained pupæ, but did not succeed in rearing the imago.

One of the authors (Busck) for several years has collected and studied these larvæ and succeeded last spring in the rearing of a large number of the exquisite moths. As the American literature on this group is so scant, it is deemed worth while to give the following notes on the life-history, and on the remarkable structure of this American species, although most of the facts have long been known from closely allied European species.

Mnemonica auricyanea is a small (12–14 mm. alar expanse) strongly iridescent, golden bronze moth, sprinkled with scintillating, bright metallic purple scales. The entire life of this little insect above ground, covers but a few weeks. All the rest of its life, more than eleven months, is passed under ground confined within its cocoon.

The imago issues in April and lays its eggs singly on the opening leaves of the Cupuliferæ, (chestnut, oak and chinquapin). In May the larva makes a large, bulgy blotch mine in the leaf. It feeds up rapidly, within a week or ten days, falls to the ground and burrows down into the soil to a remarkable depth in proportion to the size of the insect, sometimes as deep as a foot. It spins a small, very tough, oval cocoon of silk, within which it remains curled up as a larva during the summer and fall. During the winter the larva transforms into a most remarkable pupa, which possesses long, arm-like, toothed, movable mandibles, with which it cuts the tough cocoon in early spring and with which it digs its way like a mole up to the surface of the ground, where the imago issues.

The egg is rather large, oblong, 0.5 mm. by 0.2 mm., soft, white, finely sculptured with minute dots. The female has a short, horny ovipositor and inserts the eggs singly into the young leaf near the edge, generally on the outer half. Dissection of the

[1] Presented at meeting of April 2, 1914.

female abdomen shows that the number of eggs laid by a single female is about forty.

The mine, (figs. 38–39), begins as a narrow line which runs out towards the edge of the leaf. This early part of the mine is normally obliterated and makes a fissure in the leaf as this grows. This fissure is a very characteristic feature of infested leaves. After this short linear part the mine broadens out into a large bulgy blotch, which always runs out to the edge of the leaf, and normally involves the tip or one or more of the lobes. The mine is suggestive of a beetle or a sawfly mine. The entire parenchyma of the leaf is eaten out and the mine is equally visible from both sides of the leaf. It is semi-transparent, so as to show plainly the larva and the black frass, which is voided in long, irregularly curled threads, lying loosely within the mine.

The full grown larva (fig. 1), is 9–10 mm. long, apodal, whitish in color, somewhat flattened. Head small, flat, horizontal, light yellow with dark brown trophi. Thoracic segments large and bulging, first segment with lightly chitinized but rather strongly pigmented, dark brown thoracic shield and sternal plate. Abdominal segments evenly tapering to the last joint. The skin is shagreened, due to numerous minute, closely set, spine-like projections (fig. 3), all directed backward and probably used in the locomotion. One pair of thoracic and eight pairs of abdominal spiracles.

In the head (figs. 6–7), the two halves of the epicranium are dorsally strongly prolonged backwards, separated by the very deep upper portion of the occipital foramen; ventrally also they are prolonged backwards, but only half as far as on the upper side. Ventrally on the inner margin of each side of the epicranium is a large triangular piece, the hypostoma,[1] which supports the transverse bridge-shaped part of the tentorium.

On the upper side of the epicranium is found one long anterior seta, three minute setæ and several sensorial punctures, somewhat asymmetrically arranged. On the under side are found one large and five small setæ. No true ocelli, but only a large, strongly pigmented, ventral eyespot on each side near the antennal base.

The front[2] is nearly triangular, but the converging edges do not quite meet posteriorly at the occipital foramen. These edges are strongly chitinized and interiorly developed into the endoskeletal frontal ridges. The front contains two pairs of sensorial punctures but bears no setæ.

[1] This is probably the post-gena of Kellogg, Kansas Univ. Quarterly, vol. II, p. 53, 1894.

[2] We employ this term which was first used by Lyonet, (*Traité anatomique de la chenille qui ronge le bois de saule*, p. 34, 1762), and which has been adopted by Wm. T. T. Forbes, (A Structural Study of Some Caterpillars,

From the posterior end of the front runs on each side a curved translucent line to the outside of the antennal base, limiting a large, triangular area which may be homologous to the so-called adfront of Forbes; each of these areas contains two small setæ posteriorly.

The epistoma[1] is well developed and bears two pairs of minute setæ.

The epistoma is connected with the labrum by a large soft-skinned part, the post-labrum of Lyonet, (the "clypeus" or "anteclypeus" of Packard, Sharp and others).[2]

The labrum (fig. 4) is large and well chitinized, bilobed, the anterior edge rounded and slightly emarginate; on the upper side it bears one central pair of strong setæ and along the edge five pairs of smaller setæ. On the under side of labrum and slightly projecting in front of it, is the fleshy epipharynx (fig. 5) armed along the anterior margin with a series of spines and bearing on each side a large tuft of long hairs. It also has a pair of sensory pits, and two pairs of small, symmetrically arranged, elongate, elliptical, chitinous plates,[3] the proximal ones with a little tooth. The margin of the epipharynx is strengthened by lateral rod-shaped sclerites.

The antennæ (fig. 11), are short, three-jointed;[4] the basal joint is large, membranous, without spines. The second joint is well developed and well chitinized. It bears two large spines and two sensory processes. The third joint is much smaller and bears one seta and two sensory processes, the larger one of which is slightly chitinized around its base.

The mandibles (fig. 10), are strong and placed horizontally. They have three, large, pointed teeth, and a fourth, small rudimentary tooth, indicated only on the ventral side. The large, bluntly terminating cutting edge is separated from the teeth by a small incision. The outer edge bears two strong setæ, the apical one of which is on the base of the fourth rudimentary tooth. At the base of the cutting edge is a bunch of long branched hairs.

[1] Epistoma is the chitinized marginal area between the two processes on which the fossæ of the mandibles articulate. This part Forbes calls "clypeus," (l.c. p. 96, footnote), on the supposition "that this name agrees better with its homology in other orders."

[2] Forbes does not give it any name at all, and applies, as mentioned, the term "clypeus" to the epistoma.

[3] Compare the similar structure in Coleopterous larvæ mentioned by Geo. H. Carpenter and Mabel C. MacDowell in, "The Mouthparts of Some Beetle Larvæ, With Especial Reference to The Maxillulæ and Hypopharynx," The Quarterly Journal of Microscopical Science, vol. 57, 1912, pp. 373–393, figs. 10, 191, 24, and 25.

[4] We accept with reservations, Trægaardh's interpretations, (in his valuable paper, Arkiv. for zoologi, vol. 8, 1913. Stockholm). Possibly his first joint is but a basal membrane and the terminal sensory process a true joint.

The maxillæ, labium, mentum and submentum[1] are inserted in the deeply curved hypostoma.

The maxillæ (figs. 8–9), are large. The cardo is separated from the lower part of the stipes by a transverse separating line which can be seen by a careful examination. The cardo is without any setæ but terminates basally in a more strongly chitinized part. The stipes is large and bears one strong and one small seta. The palpiger is free and bears a long seta. It is fused with the subgalea and the maxillary lobes: the flat lacinia and the more joint-like galea.[2] The lacinia on the dorsal side is furnished with long stiff spines and soft hairs. The maxillary palpus is two-jointed, the basal joint having a fine transverse line and four strong spines on the dorsal side, and the terminal joint several small sensory processes.

Along the margin towards the labium the palpiger has a rod-like chitinization, which at the base is connected with a similar structure along the margin of the hypopharynx. From the connecting point starts first a staff-like thickening along the stipes, second, a similar thickening around the lateral border of the epipharynx and third, a free, rod-like prolongation to the carinated frontal suture.

The labium is somewhat broader than long with two pairs of sensory punctures; the labial stipites form an incomplete chitinous basal ring. The labial palpi have a broad short basal joint, an elongated, narrow second joint with a single seta and a minute apical joint also bearing a seta. The spinneret (the fused labial lobes) protrudes beyond the palpi and is placed ventrally, well within the anterior margin of the labium. The mentum (fig. 9), is large and unchitinized, at the base separated from a short submentum by a bow-shaped transverse line. It has a single pair of sensory punctures. The submentum is also unchitinized. On the dorsal side of the labium towards the mouth cavity, the hypopharynx is provided with a series of long branched hairs. Further down is found a chitinized plate with the rudimentary third pair of maxillæ, the socalled maxillulæ (fig. 8). They are provided with short spines and correspond exactly to homologous elements described in the beetle larvæ by Carpenter and Mabel MacDowell, (l. c. p. 375).

The body tubercles (figs. 2–3) are only discernible by their setæ, which are themselves rather small. The arrangement

[1] Forbes, (l.c. p. 96), states, "The lower lip in caterpillars is formed of the maxillæ as well as the labium," but this is a confusion of terms, as the term labium and lower lip hitherto have been regarded as synonyms.

[2] This may be more correctly interpreted as the digitus laciniæ figured by Comstock in a Coleopterous maxilla, fig. 605, in his Manual, 1895. If so, the galea is absent.

is primitive. Utilizing Dyar's numbers, these setæ may be interpreted as follows: I, II, IV, V, and VII, nearly in a line on the posterior annulet of the segment; VI small and a little in front of this line; III obliquely above and behind the spiracle, with a minute IIIA obliquely before the spiracle. Besides these, there are two minute spines (x) on the dorsal half of each joint. Thoracic legs and abdominal prolegs are wanting.

The larva is full grown about ten days after the hatching of the egg. It then cuts a small semi-circular slit in the upper epidermis of the leaf, and leaves the mine, dropping to the ground, where it at once digs down until it finds a suitable place in which to make its cocoon. Normally this is attained within a few inches or even less from the surface of the ground, often next to a stone, but in the breeding jars[1] some went down six to eight inches and there are records of even greater depths, depending presumably upon the nature and humidity of the soil. There the larva bends itself into a circle and pushes the soil aside to make a small firm cell in which it then spins its oval cocoon.

The cocoon is so tight fitting around the larva and is made of so closely woven tough silk that it is difficult to cut it open with dissecting needles without injuring the larva within. The cocoon is about 2 mm. by 4 mm., of whitish silk and with small grains of earth and sand firmly incorporated in its surface. The larva remains within this cocoon apparently unchanged during summer and fall, and not before sometime during the winter does it transform into a pupa, which also very nearly fills out the cocoon.

The pupa (figs. 19–20–21) is most extraordinary, unlike any other Lepidopterous pupa, and reminding one much more of those of Trichoptera. It has all appendages free and unfused and all the body segments movable. The head especially can be moved up and down and sideways. There is, of course, no room within the narrow confines of the cocoon for these movements, but if a pupa is taken out and lightly touched with a brush, it responds with the most grotesque nodding of its head and with the swinging out of the enormous mandibles in a deliberate manner. While all of the other appendages are loose, not glued together as is normal in a Lepidopterous pupa, it is mainly the head and the mandibles and abdominal segments, which are movable and which

[1] Common large flower pots were used. These were filled with clean sand and sifted soil, liberally mixed with small pieces of rock, and the mined leaves were laid on top thereof. As soon as the larvæ had left the leaves, these were taken away, The pots were then buried flush with the ground, inside an unheated breeding house, where they were sheltered from sun and rain, but still exposed to nearly outdoor temperature during the winter. The pots were watered half a dozen times from May to the following January, and were then placed within breeding cases for the emergence of the moths.

are utilized in locomotion, when the pupa digs up through the earth. The legs are rather feeble and immovable and are not used for this purpose as has been asserted.[1]

The pupal skin is very thin and transparent, so that the imaginal hairs and scales, as well as the eyes and ocelli can be plainly seen through it. The only part of the pupa which is strongly chitinized, besides the large mandibles, is the supporting mouth-frame (figs. 14–18) formed by epistoma, pleurostoma and hypostoma.

From the front projects downwardly a large, peculiar, beak-like, soft process, reaching above and beyond the base of the labrum. On the upper part of the front are two pairs of long, curved, stiff hairs, the same which persist on the head of most Lepidopterous pupæ (fig. 16).

The eyes are large. The antennæ are free throughout their entire length and run in a broad curve over the base of the wings and rest on the costal edge of the wings, reaching nearly to their tips. The first joint is large and elongate, four times as long as the succeeding joints. The tufts of hairs on the imaginal joints are plainly visible through the pupal sheath.

The labrum is large, subquadrate, with incurved front margin. It is rather firm and bears six pairs of long stiff bristles.

The most conspicuous of the mouth parts are the very long, stout, curved, armlike mandibles (fig. 15). These are strongly chitinized and dark brown in color. Their fossa and condylus are strongly developed and firmly jointed to the mouth frame. Their inner edge is sharply serrated nearly to the end and the apex is broadened out into a formidable club, which is abruptly cut off with a flattened, somewhat hollow end, the edges of which are armed with several strong teeth. They are capable of a strong outward swinging movement, which is used to tear the tough cocoon and afterwards to dig up through the soil.

The mandibles are moved by strong muscles (fig. 18), identical with the abductor and adductor mandibulæ found in insects with biting mouthparts, and the minute imaginal mandibles can be found within their base by dissection (fig. 14). In this connection we refer to Chapman's peculiar statement in his otherwise very lucid account of an "*Eriocranid*" pupa.[2]

[1] Sharp, in his textbook, p. 327, 1909.

[2] "That a Lepidopterous pupa should have jaws is remarkable enough; that they should be of such immense size proportionately to the insect and should be functionally active seems at first sight incredible; but the still more remarkable fact remains, that active and powerful as they are, there are no visible means of working them, as they are pupal structures, used only immediately before the emergence of the imago and have no corresponding imaginal parts attached to them.

"The whole question, how these jaws are worked, will form an interesting

The maxillary palpi (fig. 17), are bent upon themselves in five sharp curves, with the last joint pointed downwards and forwards.

The two halves of the proboscis are widely separated and outwardly curved, with their tips nearly meeting in the middle line forming a heart-shaped figure.

The labium and its three-jointed palpi are pointed downwards in two straight, divergent staffs, reaching beyond the curved proboscis.

The strongly angulated patagia,[1] (fig. 19), overlap the base of the wings behind.

The legs are folded loosely along the body, the posterior tarsi reaching beyond, and curved around the tip of the abdomen.

On the back of the pupa is a peculiar structure, the morphology and function of which is not clear to us. It consists of an unpaired, thin-walled, strap-like, longitudinal band (fig. 21, *x*), made up of three separate appendages in prolongation of each other and attached to the middle line of respectively the second and third thoracic and the first abdominal segments.

Each abdominal segment bears two lateral pairs of strong stiff spines. The spiracles are small and circular.

In early spring when the pupa is mature and ready for the emergence of the adult, the cocoon is split open by an outward movement of the mandibles which tears through the tough silk. The pupa then wriggles out of the cocoon and laboriously digs upward through the earth by the help of the mandibles, swung from the exceedingly movable head and pushed on by the movements of the abdomen. When it finally has made its way to the surface, it lies immovable for some time, during which the last acts of the transformation to adult take place. The mandibles become immovable through the withdrawal of the imaginal skin and mandibles, together with the strong muscles which remain in the imaginal head. The pupal skin now splits open on the median line of the first and second thoracic segments. The long-haired head and thorax of the imago appear in the slit and the fully developed moth issues. It at once seeks some support from which to hang with backwardly extended wing, as is usual with freshly emerged moths, but it is very quickly in condition for active flight. It is interesting to note that if the cocoon is taken out of the sand and placed on the surface for observation, as was done

research for some microanatomist. I fear my own training leaves me unequal to carry the matter much further. I am however, thoroughly satisfied on two points: first, that there are no muscles attached to these jaws, second, that there are no imaginal jaws within them, whose movements compel those of the pupal ones." Chapman, Trans. Ent. Soc. Lond. 1893, pp. 255–263.

[1] The patagina of Busck, by mistake.

with several, the pupa has a period of rest after emergence from the cocoon, during which the mandibles and the head work furiously at the least irritation with a hair-pencil, or even without such. This period evidently corresponds to the time it normally takes the pupa to work its way through the soil to the surface. Later on comes the period of immovability of the mandibles, which fail to respond even if sharply irritated. This corresponds to the resting period when the pupa under normal conditions has reached the surface.

The imago has the head (fig. 22) and face strongly tufted with long gray, brown and white hairs, which obscure the eyes and mouthparts. The antennæ are simple, dark brown, with two longitudinal light yellow lines throughout their length. Thorax strongly haired, the long brown and gray hairs arranged in three large whorled tufts, two over the patagia and one posteriorly. Forewings elongate elliptical, thickly covered with large golden scales, evenly interspersed with numerous single purplish blue metallic scales; cilia light golden brown Hindwing dark golden brown, with a purple sheen, semitransparent at base; cilia gray. Abdomen brownish gray, in the female terminating in a short, stout, brown, horny ovipositor. Legs dark gray sprinkled with purple scales; posterior tibiæ with long, sparse thin hairs on the upper side and with two pairs of well developed spurs. Alar expanse 10–13 mm. The venation is given in figures 12–13.

From the several clearly primitive characters which they possess in common, more especially in the neuration and the mode of keeping the wings together by the so-called jugum (the clavus of Spuler), there can be no doubt that the Eriocranidæ and the Micropterygidæ represent the most ancestral group of Lepidoptera. This has been generally recognized by all modern Lepidopterists, but there has been considerable difference of opinion as to the relative systematic value of these groups. Some authors have considered the active biting mouth parts of the adult Micropterygidæ of sufficient systematic value to separate this group as a distinct superfamily or even subclass. On the other hand, Meyrick regards the passage to sucking mouth parts in the Eriocranidæ as a purely biological change of structure of much less systematic significance, and he treats the two groups as closely allied subfamilies.

The actual presence of rudimentary but unmistakable mandibles also in the Eriocranidæ tends to support Meyrick's opinion of close correlation, but his description (Genera Insectorum), contains some misstatements and omissions in the anatomy of the head structures in the two groups. We consider that the differences both in the mouth parts and in the venation, as well as of

the larvæ, justify separate family rank for the Eriocranidæ and the Micropterygidæ of which the latter are by far the more ancestral, as shown in the following comparison of their head structure.

The adult Micropterygid (*Micropteryx ammanella* Hübner, is used in this comparison), has true, well developed, strongly chitinized, functional mandibles (fig. 35). These are in a general way similar to those just described in the Eriocranid pupa, but are much contracted. They have well developed fossa and condylus, jointed on the mouth-frame and are moved by strong abductor and adductor muscles. Their outer end is sharply cut off and palmate as in the Eriocranid pupa and toothed on the edges. The upper one of the outer teeth is more pointed and larger than the rest.

In the adult Eriocranid (*Mnemonica auricyanea* Walsingham) are found by dissection similar but rudimentary and unchitinized mandibles (figs. 27, 31, 33). These have not the palmate apex, and the fossa and condylus are hardly discernible, while the ligament connecting them to the mouth frame is large and cushion-like. In the pupa these mandibles are plainly visible within the base of the pupal mandibles (fig. 14), and they possess strongly developed abductor and adductor muscles (fig. 31), identical with those in the pupa. These muscles and the development within the corresponding pupal structure definitely prove the mandibular nature of these organs.[1] The presence of true biting mandibles in the Micropterygidæ is therefore not of such fundamental importance as Sharp, Tutt, and others have assigned to it, the less so as rudimentary mandibles may be distinguished in certain much higher Lepidoptera.[2] But the further presence of all the

[1] Compare Chapman's statement, above quoted, in footnote, page 156–7, which has been accepted by subsequent writers, as Sharp and Meyrick. The former states, page 308 in his textbook, (The Cambridge Natural History, vol. VI, Insects, part II, 1899), "The opinion entertained by Walter that Micropteryx proper, (his 'höhere Micropteryginen,' Meyrick's 'Eriocranianæ') also possesses rudimentary mandibles is considered by Chapman, no doubt with reason, to be erroneous." Further in the same manual, p. 437; "All the information we possess points to profound distinctions between *Micropteryx*, (our 'Eriocranidæ'), and *Eriocephala*, (our 'Micropterygidæ,' Walter's 'niedere Micropteryginen') for whereas, in the former the mandibles drop off from the pupa, so that the imago has no mandibles, in the latter, the mandibles exist." Meyrick, in his monograph of the Micropterygidæ (*Genera Insectorum*, 912, p. 3), simply states in the diagnosis of his subfamily *Eriocraninæ*, "No mandibles." On the other hand, it should be noted that Alfred Walter in his excellent work on the morphology of the Lepidoptera, (Jenaische Zeitschrift für Naturwissens., Bd. 18, 1884, neue Folge Bd. II, p. 751–807, 2 plates), has correctly interpreted these structures in what he calls the "höhere Micropterygidæ."

[2] The weak and functionless mandibles have been recognized later by Kellogg, (The Mouthparts of the Lepidoptera, Am. Nat. vol. 29, p. 546, 1895), by Packard, (On a new Classification of the Lepidoptera, Am. Natur.

other trophi also identical with those found in insects with biting mouth parts, and even maxillulæ lobes on hypopharynx (fig. 37), proves the Micropterygidæ a much more ancient group than the Eriocranidæ, which possess none of these characteristics but has a true sucking mouth.

In the Micropterygidæ the maxillæ consist of a well developed cardo and stipes (figs. 36–37), a palpiger which carries the six-jointed palpus, and a subgalea which carries a distinct, well chitinized lacinia with a few setæ, and a two-jointed galea, the basal joint of which is short and well chitinized, while the terminal joint is soft and leaf-shaped, with a longitudinal series of setæ.

The Eriocranidæ (figs. 29–30), also possess distinct cardo and stipes, as well as a six-jointed palpus, and the galea is also two-jointed, but they lack altogether the lacinia, and the terminal joint of the galea is developed into one of the hollow sheaths of a true proboscis, is curved, has the typical serrations (figs. 25–26), which serve to connect it with the other half of the proboscis, and has the usual parallel ring structure and surface cilia placed in transverse lines.

Both the Micropterygidæ and the Eriocranidæ possess a labium with a well developed, three-jointed palpus, the apical joint with the usual sensitive groove,[1] represented merely by a depression containing the rows of sensitive cones. But in the Micropterygidæ is found a setæ-bearing lobe, corresponding to the galea of the maxillæ, issuing from the so-called basal joint of the palpus, which should rather be interpreted as stipes labii. Of this setæ-bearing lobe there is no vestige in the Eriocranidæ. Finally, only the Micropterygidæ, as already mentioned possess the two maxillulæ lobes, lateral to the hypopharynx.[2]

The authors are under great obligations to their friend Rev. J. DeGryse, for the several excellent figures (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 19, and 21), of the larval and pupal structures, which he has studied most diligently and carefully, thus contributing very considerably to the value of this paper.

The other figures, except the venation, were drawn by Adam Böving.

vol. 29, p. 636, 1895) and by Francis X. Williams, (A New Eriocrania from the Pacific Coast, Ent. News, p. 14, 1908).

[1] Pointed out by O. Von Rath: Zool. Anzeiger 1887, p. 627; Zeitschrift f. Wissench. Zoölogie, Bd. 46, 1888.

[2] These investigations of the maxillary, labial, and maxillulary structures fully substantiate the writings of Dr. Walter, who has already pointed out most of the above mentioned characters in his excellent paper. In the middle of the hypopharynx is plainly seen in our slides, both of the Micropterygidæ and the Eriocranidæ, the opening of the salivary glands, which Walter was not able to discern on account of the condition of his material.

EXPLANATION OF PLATES.

PLATE IX. *Mnemonica auricyanea* Walsingham, larva.

Fig. 1, lateral view of full grown larva.

Fig. 2, lateral view of flattened larval skin; SP, thoracic spiracle; *sp*, abdominal spiracles.

Fig. 3, details of the sixth abdominal segment, lateral view; *x*, small unnumbered setæ.

PLATE X. *Mnemonica auricyanea* Walsingham, larva.

Fig. 4, dorsal view of epipharynx, labrum and post-labrum; *ex*, epipharynx; *lr*, labrum; *pl*, post-labrum; *mb*, median bristles.

Fig. 5, ventral view of epipharynx; *ch*, hairtuft; *ep ext*, exterior epipharyngeal plate; *ep int*, interior epipharyngeal plate; *er*, rod along the margin; *es*, sensory puncture; *ex*, epipharynx.

Fig. 6, dorsal view of head, *a*, (on detail A), dorsal mandibular articulation; *af*, adfront; *afl*, adfrontal line; *an*, annulus around the antennal base; *c*, (on detail A), carinated lateral margin of front; *e*, (on detail A), epistoma; *epc*, epicranium; *f*, front; *of*, occipital foramen; *pl*, post-labrum.

Fig. 7, ventral view of head; *epc*, epicranium; *h*, hypostoma with *i*, impression where tentorium is attached; *m*, mentum; *ocl*, eyespot.

PLATE XI. *Mnemonica auricyanea* Walsingham, larva and wing venation of the imago.

Fig. 8, maxillæ, hypopharynx and maxillulæ; *bb*, branched bristles; *ds*, duct of salivary glands; *epc*, margin of epicranium; *g*, galea or digitus lacinia; *hr*, chitinous rod of hypopharynx; *hx*, hypopharynx; *l*, lacinia; *mp*, basal joint of maxillary palpus; *mxl*, maxillulæ; *spr*, spinneret.

Fig. 9, ventral view of maxillæ and labium; *cr*, cardo; *crr*, chitinization along inner edge of cardo; *lp*, basal joint of labial palpus; *lst*, labial stipes; *m*, mentum; *mpI*, basal joint of maxillary palpus; *mpII*, terminal joint; *plg*, palpiger; *sm*, submentum; *r*, chitinous rod along the inner margin of lacinia; *st*, maxillary stipes; *str*, chitinous rod along the margin of maxillary stipes.

Fig. 10, left mandible, ventral view.

Fig. 11, dorsal view of right antenna; *an*, annulus around antennal base; *at*, large papilla or terminal joint.

Fig. 12, venation of forewing.

Fig. 13, venation of hindwing.

PLATE XII. *Mnemonica auricyanea* Walsingham, pupa.

Fig. 14, labrum and mandibles of the imago within the labrum and mandibles of the pupa; labrum and mandibles of the pupa indicated with dotted lines; *mf*, mouthframe.

Fig. 15, ventral view of left mandible.

Fig. 16, dorsal view of head; *ant*, antenna; *fs*, frontal setæ; *lp*, labial palpus; *lr*, labrum; *md*, mandible; *mf*, mouth frame; *mp*, maxillary palpus; *bk*, beaklike prolongation of front; *pr*, proboscis.

Fig. 17, ventral view of head; *epc*, epicranium; *h*, hypostoma; *lp*, labial

palpus; *m*, mentum; *md*, mandible; *mp*, maxillary palpus; *ofI*, anterior part of occipital foramen; *ofII*, posterior part of occipital foramen; *oc*, compound eye; *pr*, half part of proboscis; *sm*, submentum; *tb*, bridge of tentorium; *st*, stipes.

Fig. 18, mouth frame and mandible with musculature, dorsal view; *ab*, abductor muscle of mandible; *ad*, adductor muscle of mandible; *d*, dorsal process of mouth frame on which fossa of the mandible articulates; *mf*, mouth frame; *t*, tendon; *v*, ventral socket of mouth frame on which condylus of mandible articulates.

PLATE XIII. *Mnemonica auricyanea* Walsingham, pupa.

Fig. 19, lateral view; *pt*, patagium.

Fig. 20, ventral view.

Fig. 21, dorsal view; *x*, thin-walled dorsal appendices.

PLATE XIV. *Mnemonica auricyanea* Walsingham, imago.

Fig. 22, lateral view of head; *ant*, antenna; *e*, epistoma; *epc*, epicranium; *f*, front; *lp*, labial palpus; *l*, labrum; *md*, mandible; *mf*, mouth frame; *mp*, maxillary palpus; *ocl*, ocellus; *pl*, post-labrum; *pr*, proboscis.

Fig. 23, epipharynx and hypopharynx; *mm*, membrane of mouth; *ex*, epipharynx; *hx*, hypopharynx; *pap*, sensory papilla; *ph*, pharynx; *sc*, scales; *w*, sensory wart.

Fig. 24, dorsal view of head; *an*, antennal ring; *epc*, epicranium; *f*, front; *oc*, compound eye; *ocl*, simple eye; *ha*, hair-bearing area.

Fig. 25, apex of right half of proboscis from inner side.

Fig. 26, base of right half of proboscis from inner side; *ci*, cilia belonging to the external parallel series; *fri*, stiff connecting fringes of ventral margin; *th*, transverse ring-structure.

Fig. 27, ventral view of head; *ex*, epipharynx; *h*, hypostoma; *hx*, hypopharynx; *m*, attachment of mentum; *md*, mandible; *mx*, attachment of maxilla; *ofI*, anterior portion of occipital foramen; *ofII*, posterior portion of occipital foramen; *tb*, bridge of tentorium; *v*, ventral mandibular articulation.

Fig. 28, ventral side of labium; *lp*, labial palpus; *m*, mentum; *VR*, organ discovered by Von Rath.

Fig. 29, buccal surface of left maxilla; *c*, cardo; *gI*, basal joint of galea; *gII*, terminal joint of galea developed as left half of proboscis; *h*, hypostoma; *mp*, maxillary palpus; *plg*, palpiger; *sgl*, subgalea.

Fig. 30, ventral side of right maxilla; *c*, cardo; *gI*, basal joint of galea; *gII*, terminal joint of galea; *mp*, maxillary palpus; *plg*, palpiger; *sg*, subgalea; *st*, stipes.

PLATE XV. *Mnemonica auricyanea* Walsingham, imago, figs. 31–33.

Fig. 31, ventral view of right mandible; *ab*, abductor muscle; *ad*, adductor muscle; *t*, tendon.

Fig. 32, frontal view of head; *ant*, antenna; *epc*, epicranium; *e*, epistoma; *f*, front; *lr*, labrum; *lp*, labial palpus; *m*, mentum; *md*, mandible; *mp*, maxillary palpus; *pl*, post-labrum; *plg*, palpiger; *pr*, proboscis (= terminal joint of galea); *sm*, submentum.

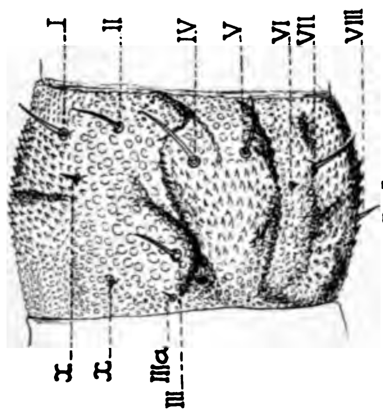


Fig. 3

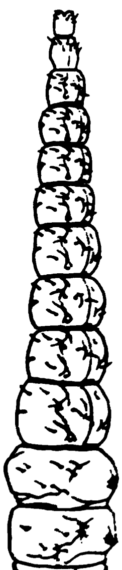


Fig. 1

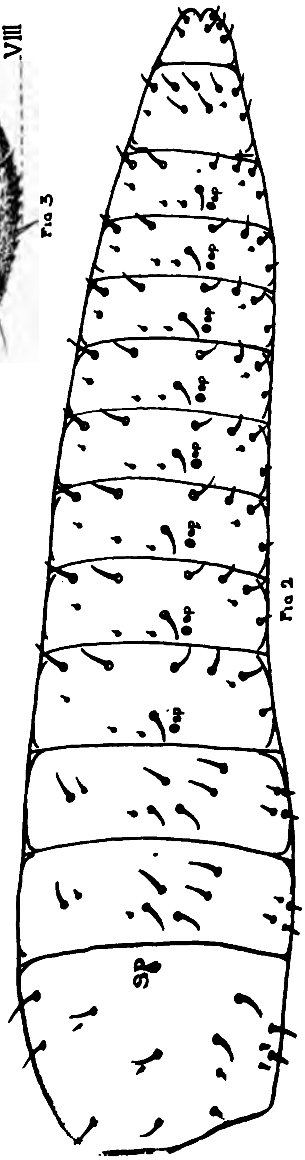


Fig. 2

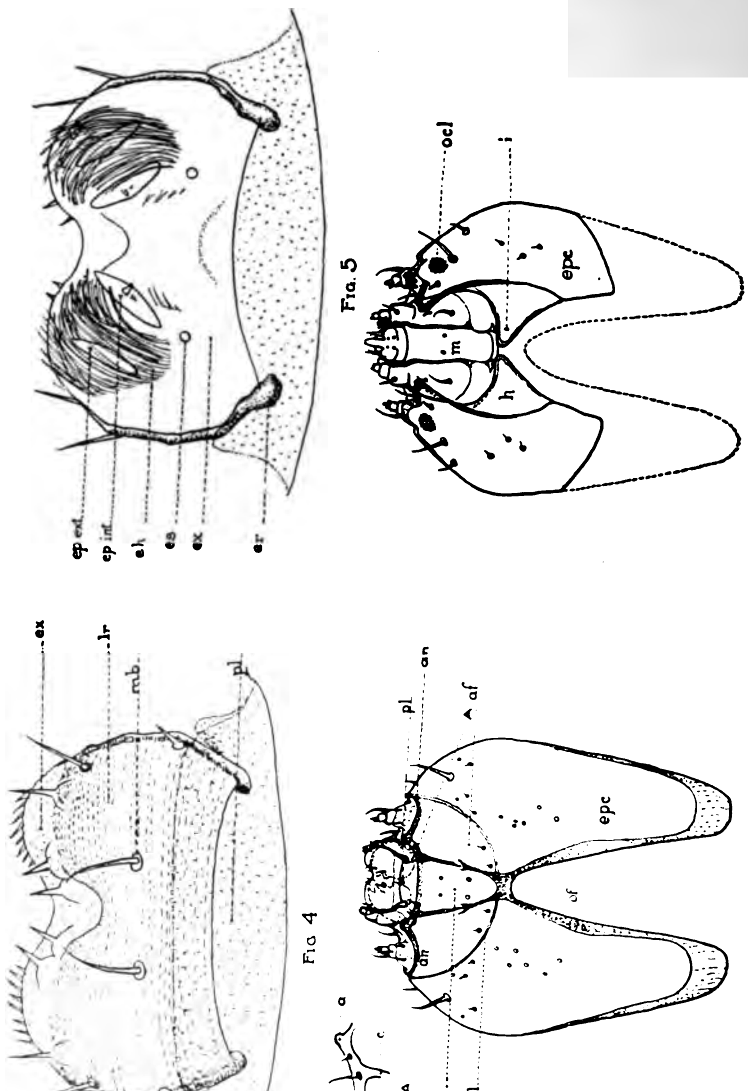


Fig. 4

Fig. 5

Fig. 6

Fig. 7

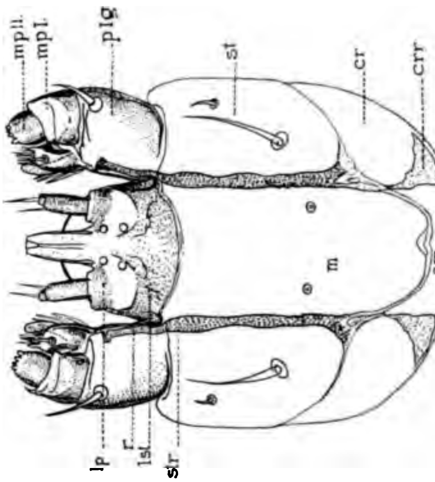


FIG. 9

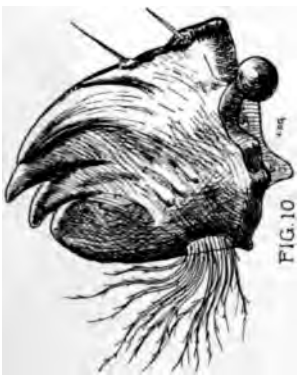


FIG. 10

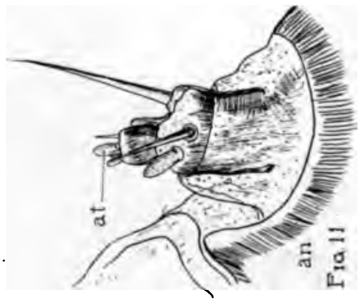


FIG. 11

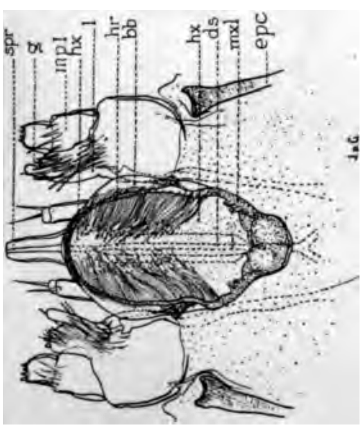


FIG. 8

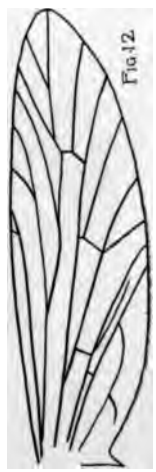


FIG. 12

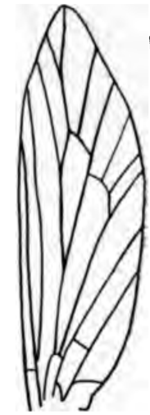


FIG. 13

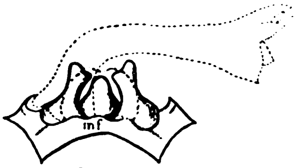


FIG. 14

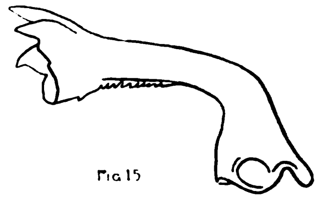


FIG. 15

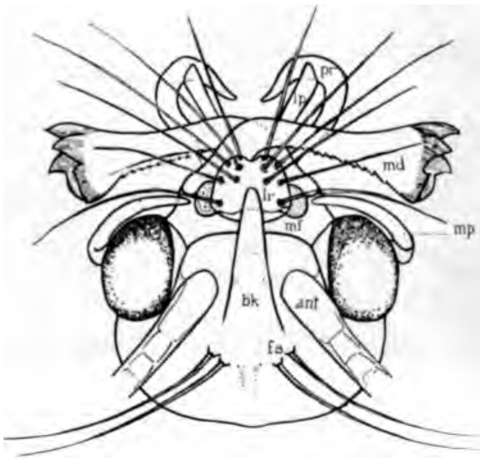
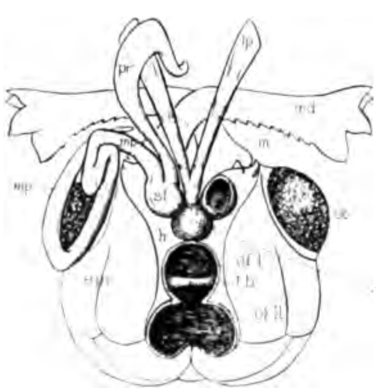
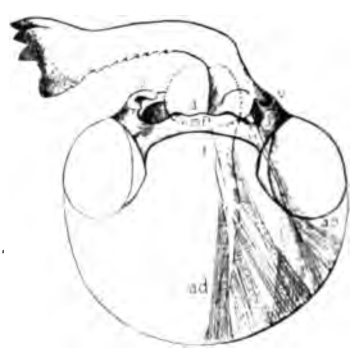


FIG. 16





[redacted]

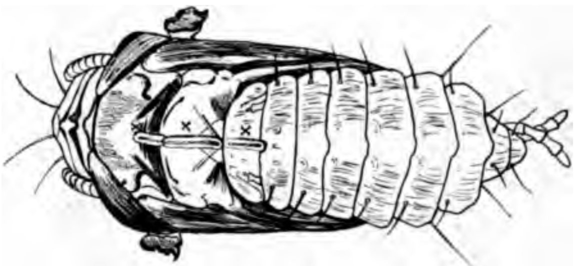


FIG. 21

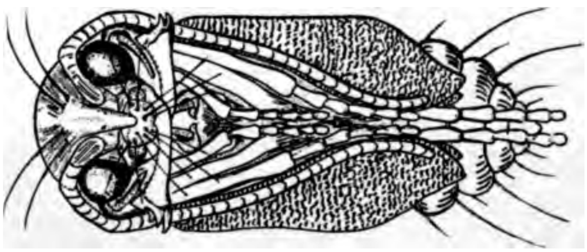


FIG. 20

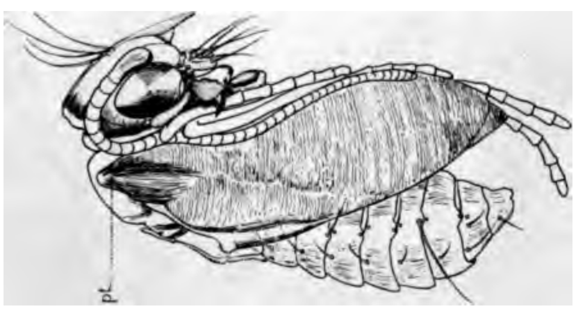


FIG. 19

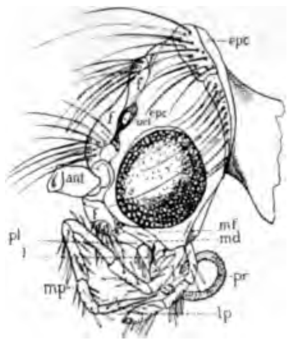


Fig. 22

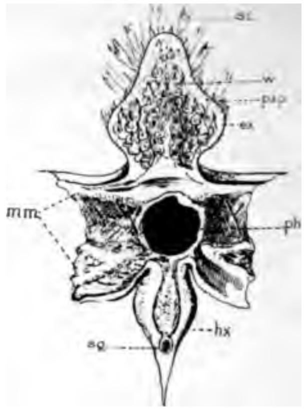


Fig. 23

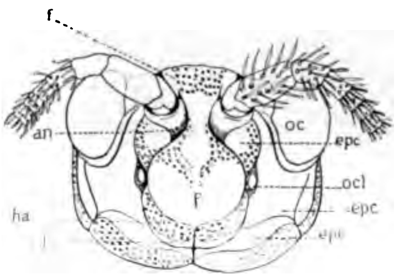


Fig. 24

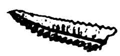


Fig. 25

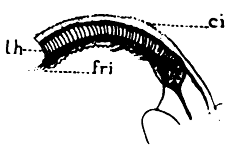


Fig. 26

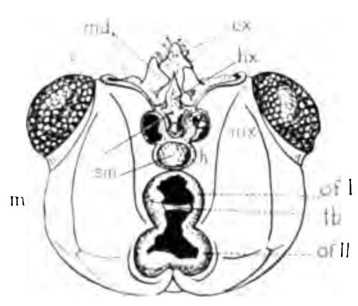


Fig. 27

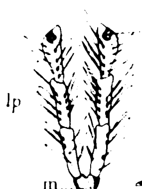


Fig. 28

Fig. 29

Fig. 30

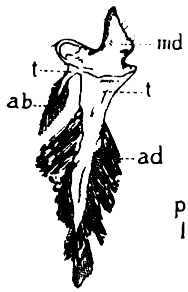


FIG. 31

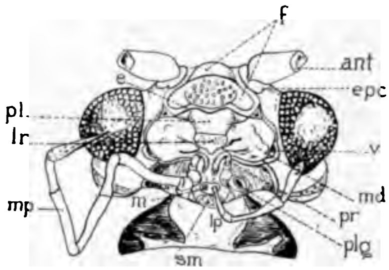


FIG. 32

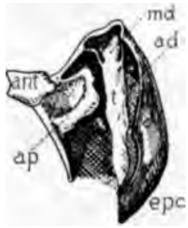


FIG. 33

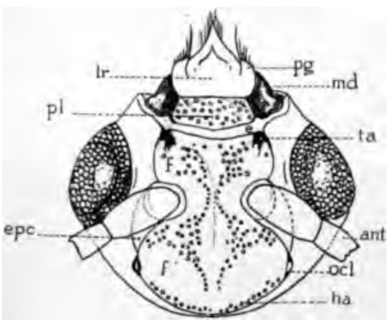


FIG. 34

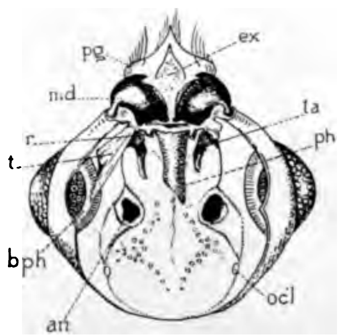


FIG. 35

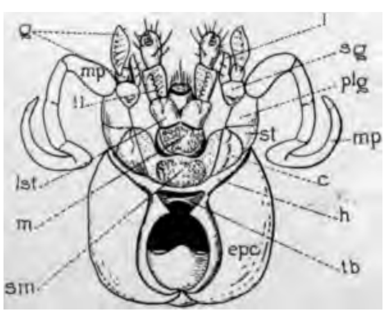


FIG. 36

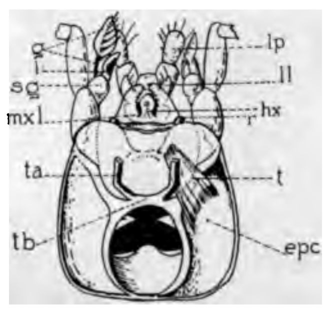


FIG. 37

Fig 38.

Fig. 39.

Fig. 33, interior view of a piece of the head of a dry specimen; *ad*, adductor mandibuli; *epc*, epicranium; *md*, mandible; *t*, tendon; *ap*, process to which antennæ muscles are attached.

Micropteryx ammanella Hüber, imago, figs. 34–37.

Fig. 34, dorsal view of head; *ant*, antenna; *epc*, epicranium; *ha*, hair-bearing area; *lr*, labrum, *md*, mandible; *ocl*, ocellus; *pg*, pilifer; *pl*, post-labrum; *ta*, spot indicating the interior attachment of tentorial arm.

Fig. 35, upper portion of head from inner side; *an*, antennal ring; *ex*, epipharynx; *md*, mandible; *ocl*, ocellus; *pg*, pilifer; *ph*, pharynx; *r*, endoskeletal rod; *t*, tendon of mandible; *ta*, tentorial arm.

Fig. 36, ventral view of head; *c*, cardo; *epc*, epicranium; *g*, galea; *h*, hypostoma; *l*, lacinia; *ll*, labial lobe; *lst*, labial stipes; *m*, mentum; *mp*, maxillary palpus; *plg*, palpiger; *sg*, subgalea; *sm*, submentum; *st*, stipes; *tb*, tentorial bridge.

Fig. 37, lower portion of head from inner side; *epc*, epicranium; *g*, galea; *hx*, hypopharynx; *l*, lacinia; *ll*, labial lobe; *mxl*, maxillula; *lp*, labial palpus; *r*, endoskeletal rod; *sg*, subgalea; *t*, tendon of mandible; *ta*, tentorial arm; *tb*, tentorial bridge.

PLATE XVI. *Mnemonica auricyanea* Walsingham.

Fig. 38, young mine and egg puncture in chestnut leaf.

Fig. 39, old mines.

AQUATIC BEETLES, ESPECIALLY HYDROSCAPHA, IN HOT SPRINGS, IN ARIZONA.[1]

BY E. A. SCHWARZ, *Bureau of Entomology.*

In 1891 on the occasion of the meeting of the A. A. A. S. at Washington, D. C., I prepared for publication a letter just received from our lamented friend and former president of this Society, Mr. H. G. Hubbard, relating to insect life in the hot springs of the Yellowstone National Park. This letter has been published in the Canad. Ent., vol. 23, pp. 226–230. At the same time I made myself a little acquainted with the literature on insect life in hot water and found that in America there is only one paper referring to this subject, namely by Dr. A. S. Packard, published in the American Naturalist on a Stratiomyid (Diptera) larva found in Wyoming. (This same paper is mentioned by Dr. Sharp in the Cambridge Nat. History.) In this instance the Dipterous larva was found in hot water *estimated* only 20 or 30° below the boiling point. In the case of Mr. Hubbard's observations in the Yellowstone Park he expresses his regrets at not

[1] Presented at meeting of April 2, 1914.

having a thermometer at his disposal, but at one place he found semi-aquatic insect life close to springs and creeks the water of which is close to the boiling point. The European literature on the subject is very meager and like the American references only proves that there are no genera or even species of true insects which exclusively live in hot water, but that there are insects that are very fond of living and even developing in or near hot or very warm water but which are at the same time found in or near water of moderate or even cold temperature. On the other hand it cannot be denied that many aquatic insects are very particular in the selection of their habitat as you can easily see even in the vicinity of Washington. Some insects live exclusively in very cold springs, others live only in the shaded, small creeks emptying into the Potomac or Rock Creek; others live in the broader and more sunny creeks such as the Eastern Branch, while the fauna of the Potomac River and its immediate shore has many peculiarities of its own.

Knowing all this and with the expectation of not finding anything of special interest in the creek at Castle Hot Springs in Arizona, Mr. H. S. Barber and I visited that place at the end of June in 1901.

The little resort of Hot Springs is situated in Castle Creek canyon, Yavapai County, Arizona, near the southern end of the Wickenburg Mountains at an altitude of 1970 feet. Steep and high cliffs rising to about 3000 feet elevation surround the place on all sides. The country is extremely arid but its scanty vegetation with its giant cactus, various other species of the same family, its acacias, mesquite, etc., is not much different in general aspect from that at numerous places in southern Arizona. The hot springs themselves originate at the head of a little gorge about 150 feet above the bottom of the canyon. Where the water comes out of small crevices in the solid rock its temperature is 115° Fahrenheit (apparently not varying throughout the year). It falls then into an upper basin where the temperature is but little lower than at the spring itself. This basin is surrounded by steep rocks and there is no vegetation in the water except a bluish green alga, and on the wet marginal rocks a brownish yellow alga containing much calcareous matter. Thence there is a waterfall of several feet and the hot water meanders as a small creek over rocks and stones through the middle part of the gorge. Here the temperature of the water is already considerably lower, perhaps less than 100°, and the creek is lined with a dense growth of tall reeds, the rootlets of which, mingled with the same green alga, form a swampy but quite warm breeding place for insects. Arrived at the bottom of the gorge the water has (in summertime) a temperature of 94°. It is used for drinking purposes, sup-

plies two little fountains and irrigates a tiny garden. The creek is here lined with willow bushes, grass and other green vegetation. Beyond this place the creek disappears in the thirsty sand of the canyon.

The following aquatic or semi-aquatic insects were found by Mr. H. S. Barber and myself in or near this creek during a short visit at the end of June 1901, but a large part of our collection, including the entire alcoholic material was lost in the conflagration which destroyed the city of Williams, Arizona, on July 2, 1901. In December 1913 we again visited the place but either on account of the cold weather or on account of the various "improvements" in the bed of the creek, insect life was much scantier than in the summer of 1901.

In the upper basin and at the head of the spring the following species occurred:

Helochares normatus.
Hydroscapha natans.
A water mite (Hydrachnid).

In or along the middle course of the creek:

Bidessus subtilis.
Laccophilus pictus.
Helophorus obscurus.
Epimetopus nov. spec.
Helochares normatus.
Chætarthria minor.
Creniphilus subcupreus.
Berosus sp.
Hydroscapha natans.
Larva of a Cyphonid (*Scirtes?*)
Simulium sp. (larvæ and pupæ)
Two species of minute aquatic Dipterous larvæ (Chironomidæ).

On the muddy banks of the creek occurred also quite a fauna of riparian Coleoptera of the genera *Schizogenius, Bembidium, Tachys, Tanygnathus, Actobius, Stenus, Sunius, Medon, Apocellus,* and various *Aleocharinæ*. On the tall reeds a species of Aphididæ occurred which was fed upon by *Scymnus flebilis* and its varieties.

In the lower part of the creek the same aquatic Coleoptera were found with the exception of the *Epimetopus* but there was a species of *Dryops* and additional riparian species.

An opportunity to compare the hot water fauna with that of cold water in the same region presented itself in what is called the "Four Tanks" which are merely enormous "potholes" or round waterworn basins cut in the rock by the drainage of a small valley descending the abrupt wall of the canyon through a narrow

cleft. These four reservoirs are situated one above the other almost as gigantic steps, the lower broken so that water does not stand in it, and only the second is accessible by ladder and contains two to six feet of water. In this water the following insects were taken in June 1901:

Cnemidotus (*Peltodytes*) *simplex*.
Desmopachria n. sp.
Desmopachria mexicana.
Laccophilus terminatus.
Laccophilus lateralis.
Laccophilus ellipticus.
Bidessus vinctellus.
Bidessus subtilis.
Hydroporus corvinus.
Thermonectes marmoratus.
Hydrochus vagus.
Hydræna sp.
Berosus n. sp.
Helochares normatus.
Odonate larvæ (Dragon flies), various species.

It will be seen that the interest in the insects found in the Hot Springs of Arizona centers in two species of Coleoptera, viz., the Hydrophilid, *Epimetopus* and the little *Hydroscapha* which is, according to all authorities the representative of a separate family. A description and figure of the new *Epimetopus* will be furnished at some future time but the occurrence of the genus *Hydroscapha* so remote from its type locality, and moreover the discovery of its earlier stages present a peculiar interest so that I feel justified in presenting a bibliography of the genus and a short account of the circumstances under which the genus has been found in Arizona. These notes are intended solely as an introduction to the following important paper by Dr. Böving. Whether or not the Arizonan species of *Hydroscapha* is different from the Californian species (*natans*) can not be ascertained at present since specimens of the latter are not at hand for comparison.

BIBLIOGRAPHY OF HYDROSCAPHA.

1874. LeConte, (Trans. Am. Ent. Soc. v, pp. 45-46) in erecting the family *Hydroscaphidæ*, with *H. natans* Lec. as the only species, says: "[This insect] seems to me another of the synthetic types gradually becoming known to us among the smaller and more obscure forms, connecting several different families of the Clavicorn series, in this instance the Hydrophilidæ, Scaphidiidæ, and perhaps the Trichopterygidæ. In the accepted arrangement of Coleoptera it must be considered as indicating a new family."

H. natans Lec., the type species, was found by Mr. G. R. Crotch abundantly at Los Angeles in the river. LeConte says: "Mr. Crotch informs me that this very singular insect resembles in appearance some of the species of *Limnebius*."

1874. D. SHARP, On a new family of European Coleoptera, (Ent. Mo. Mag. vol. XI, 1874, pp. 101–104). Reproduces LeConte's article in full; corrects LeConte's statements regarding number of tarsal joints (only 3-jointed) and number of antennal joints (only 8 joints). He becomes aware that several species of this genus occur also in Europe and describes *H. crotchii* from Madrid, Spain, which had hitherto been considered a species of *Limnebius*.

1876. REV. A. MATTHEWS, (Essay on the genus Hydroscapha Lec. London, 20 pp., 1 plate). This paper I have not seen but it is referred to by LeConte and Horn (1883).

1877. In the second edition of the Catalogus Coleopterorum Europæ the authors in ignorance of American literature credit the genus *Hydroscapha* to Dr. Sharp and place it as a kind of subfamily in the Scaphidiidæ.

1883. In the third edition of the same Catalogus, the genus *Hydroscapha* is again credited to Dr. Sharp but placed between the Sphæridiidæ and Trichopterygidæ as a kind of subfamily.

1883. CL. REY, Sur le genre Hydroscapha. (Rev. d'Entom. II, p. 84) Gives parallel descriptions of the genera *Limnebius* and *Hydroscapha,* and comes to the conclusion that *Hydroscapha* is closely allied to Limnebius of the family Hydrophilidæ.

1883. DAVID SHARP, Un mot sur le genre Hydroscapha. (Revue d'Entomol. II, p. 117) Replies sharply to Mr. Rey and accuses him of total ignorance of the literature on *Hydroscapha*. The latter should be considered either as a new family or as an aquatic tribe of the Trichopterygidæ.

1883. LECONTE and HORN, (Classification of the Coleoptera of North America, p. 180) place the family Hydroscaphidæ between the Trichopterygidæ and Sphæriidæ, and refer as follows to Matthews' (1876) paper. "The Rev. A. Matthews has since published a memoir on the genus in which he shows that the affinities are strongly towards Trichopterygidæ with tendencies as indicated by Dr. LeConte toward Hydrophilidæ."

1884. REV. A. MATTHEWS, Synopsis of the North American Trichopterygidæ (Tr. Am. Ent. Soc. XI, pp. 115–116) gives a description of the genus *Hydroscapha* and the species *H. natans* Lec. among the family Trichopterygidæ.

1889. FLACH, (Verh. Zool. Bot. Ges. Wien. vol. XXXIX, p. 523). I failed to see this reference.

1899. L. GANGLBAUER, (Die Käfer von Mitteleuropa, III, part I, pp. 332–335) Recognizes LeConte's genus *Hydroscapha* as a separate family

which he places between the Trichopterygidæ and the Scaphidiidæ. Rejects Rey's conclusion that *Hydroscapha* is closely allied to *Limnebius*. Has not seen Matthews' (1876) article.

1901. H. C. FALL, The Coleoptera of Southern California (Occas. papers of the Calif. Ac. Sc. VIII, 1901, p. 80) says: "*H. natans* is probably not a rare insect, though very seldom taken; when one is discovered a considerable number may usually be obtained by patient search. I have taken it close to the bank in a mountain stream, and also in a muddy spot in a cow pasture near Pomona."

1906. In the latest edition of the Europ. Coleopt. Catalogue by L. V. Heyden, E. Reitter and J. Weise the genus *Hydroscapha* is finally accredited to LeConte and placed as a full-fledged family between the Trichopterygidæ and Scaphidiidæ.

[References to the European species of Hydroscapha are omitted from this list.]

In the year 1901 Mr. Barber found it commonly in the fountain at the mouth of the gorge, while in December 1913 the beetle did not occur at the same place, the water at that time being much colder, but on both occasions it occurred at the head of the spring and in the middle course of the creek. It is not a swimming beetle but always occurs among the algæ growing on the rocks at the very edge of the water. They were much more abundant where the flow from the spring itself was so shallow on the algæ that the beetles could crawl freely with their backs at the surface, and under these circumstances the water did not wet the middle part of the elytra, but the larvæ among the adults were completely submerged. The beetle itself is quite conspicuous in spite of its small size; its movements while by no means rapid are quite perceptible, in fact its whole behavior and appearance with its extended abdomen reminds one forcibly, except for the aquatic habit, of the Staphylinid genus *Erchomus*. The specimens are difficult to secure and in some instances they disappear suddenly, apparently taking flight. The larvæ as found by Mr. Barber are of the same color as the rocks and difficult to observe although fully exposed and not covered by the algæ.

A box filled with algæ containing larvæ and imagoes of *Hydroscapha* was at once mailed to Washington, where in the course of time Dr. Böving not only was able to make a thorough study of the larvæ but also discovered eggs and the pupa. He also pointed out the conspicuous air reservoir showing through the elytra of the living adults and extending behind the elytral apices on account of rather long projecting ciliæ. Thus the biology of another family of Coleoptera of uncertain position has been ascertained.

NOTES ON THE LARVA OF HYDROSCAPHA AND SOME OTHER AQUATIC LARVÆ FROM ARIZONA.[1]

(With Plates XVII and XVIII.)

By Adam Böving, Ph.D., *Bureau of Entomology.*

In the material brought home by Mr. E. A. Schwarz and Mr. H. S. Barber from Arizona are four hitherto unknown aquatic Coleopterous larvæ, collected in December, 1913, in the hot water at the Castle Hot Springs. Mr. Schwarz and Mr. Barber have been so kind as to ask me to determine these larvæ.

Two of the forms are undoubtedly Hydrophilid larvæ, namely: those of *Helochares normatus* Lec. and *Creniphilus subcupreus* Say.

A European larva of the genus *Helochares* (*H. lividus* Forst.) has recently been described with a good figure in the excellent work of A. d'Orchymont[2] and I am well acquainted with this larva which has been reared by Mr. Wm. Schlick (May 21, 1889, and Mr. E. Rosenberg May 12, 1895) in Denmark.[3] The American species conforms exactly with the European generic type and the specific determination cannot be in doubt because *Helochares normatus* Lec. is the only species of the genus found in the locality.

The second Hydrophilid larva, *Creniphilus subcupreus*, was also collected in connection with the adult; it belongs to the *Hydrobius* group, which is well known from Schiödte's description and figure of *Hydrobius fuscipes*.[4]

The third larva (fig. 1) cannot be definitely determined. Without doubt, however, it belongs to the Helodidæ of the *Cyphonid* or *Microcara* type, with which family it agrees in the remarkable shape of the hairy mouth-parts, the hypopharynx and epipharynx and in the presence of anal gills. Unfortunately the antennæ have been broken in both of the specimens of which the material consists.[5] The Helodidæ are represented as adults in the material by specimens of a new species of *Scirtes*, (cf. the preceding paper by Mr. E. A. Schwarz.)

[1] Presented at meeting of April 2, 1914.

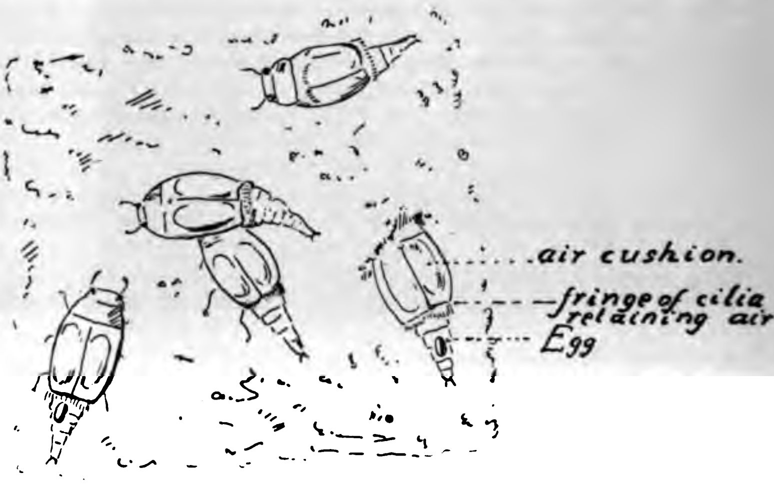
[2] Contribution a l'étude des larves Hydrophilides, "Annales de Biologic lacustre, Tom. VI, 1913, p. 200."

[3] I take the opportunity to mention that the larva described by M. d'Orchymont as *Laccobius* (?) does not belong to this genus. The larva of *Laccobius* has been bred in Denmark from eggs, by Mr. Wm. Schlick and has later been followed through all stages by Dr. Wesenberg Lund.

[4] This figure, by the way, is not quite correct because it shows the anterior edge of what Schiödte calls the clypeus, straight, and not asymmetric, as it is in this entire group.

[5] Compare the very interesting statement about the dimorphism of the antennæ by P. de Peyerimhof: "Le double type larvaire de *Prionocyphon serricornis* Müll." Bulletin de la Soc. Ent. de France, 1913, No. 6, p. 148.

The fourth larva is that of *Hydroscapha natans* Lec. and is by far the most interesting of them (figs. 2–13). The species is represented in all stages, from egg to imago. The eggs are in proportion remarkably large, oval, smooth, dark brown, without sculpture. I observed them first in numbers, attached to the algæ with which they were received, and found them afterwards within the female. Only one egg is developed at a time, and this occupies nearly one-fourth of the abdomen, (fig. I). A single pupa only was found and this is in too poor condition to describe properly. I give a mere outline of the form in figure II.



Sketch from life showing Hydroscapha on natural substratum.

Fig. I. *Hydroscapha* in natural positions.

Three larval stages are in the material and evidently no more occur. The first stage is, as is often the case in Coleopterous larvæ, somewhat different from the two following, and especially is the pair of peculiar appendices on the eighth abdominal segment (*fi*, fig. 7) relatively longer than in the two later stages. The full grown larva (figs. 2, 4) is 1.5 mm, long, dark grey, with the anterior and posterior portion of each segment whitish and soft skinned; the number, arrangement, form and length of the setæ and the sensorial punctures on the different parts of the body are shown on the figures (figs. 2, 4). The head is bent

downward. There are five ocelli in a whitish area as shown on the figure (fig. 4). The labrum (*lr*, fig. 5) is large and broad like an eyeshade; it covers and protects the mouth-parts, but works at the same time as a scraper; it is firmly connected with the front, no clypeus intervening but a suture (*c.s.*) is easily observed. The front (*f*) is nearly triangular, the interior angles (*i*) being very obtuse; the exterior angles (*e*) are acute and the posterior angle (*p*) is approximately 60°; the frontal sutures (*f.s.*) are slightly inwardly curved. The dorsal portion of the epicranium is flat and large, the epicranial suture (*es*) short, and on the ventral side the epicranial margin is strengthened by a hypostomal chitinization (*h*, fig. 6). The anterior portion of this margin forms a deep and broad curve, within which are placed the second and third pair of trophi. The posterior portion is one-fourth as long as the anterior and borders on a broad gula (*gu*, fig. 6). The antennal ring (*a*, fig. 5) is large and somewhat triangular, and the connect-

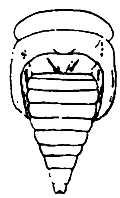


Fig. II. Pupa of *Hydroscapha.*

ing membrane is also large. The antenna itself consists only of a small basal piece (*b*, fig. 5) which carries two long, slender processes, one of which is possibly the second antennal joint, the other a sensitive papilla. On the end of the supposedly second joint a very diminutive third joint seems to be present.

The mouth-parts are well adapted to chew off and force into the pharynx the jelly-like algæ on which the larva subsists. The mandibles (fig. 9) have a very large, broad and depressed molar part (*mo*) and a slender, upright, terminal part (*t*); the tip of which is produced into a little hand-like rake; a pectinate lacinia mobilis (*lm*) is inserted between the molar and the terminal parts. The form of the maxillæ (fig. 6) is very characteristic; they have a large cardo (*ca*) and a well developed stipes (*st*), and a flat chitinized lacinia (*la*) with a series of large, flattened setæ and a spine-like galea (*g*) close to the lacinia. The maxillary palpus is three-jointed, the basal joint with a little process on the outside. The labium (fig. 6) has short, two-jointed labial palpi and a fleshy ligula (*li*). Both mentum (*m*) and submentum (*sm*) are well developed, almost quadratic. The large connecting lobe (*mc*) be-

tween the submentum and the maxilla is indistinctly separated from the submentum.

The thoracic segments (fig. 2) are nearly twice as broad as the middle abdominal segments. The chitinized upper side is rounded and protects the soft ventral part as a shield. The stout curved legs (figs. 4, 8) can be drawn in under the edges of this shield. The coxa (*cx*) is large and mobile, and the femur (*fe*) and tibia (*ti*) are approximately of equal size, and only half as thick and long as the coxa. The tarsus (*ta*) is large and unguliform, without claws.

The abdomen (figs. 2, 4) is ten-jointed; the chitinized portion of each abdominal segment forming a continuous closed ring without any soft lateral zone. The soft-skinned portion between the rings is broad and the segments can be telescoped to a considerable extent. On the eighth abdominal segment is a pair of cerci-like filaments (*fi*, figs. 4, 7) but true cerci, which always belong to the ninth abdominal segment, are entirely absent. The filaments are two-jointed, and consist of a cylindrical, well chitinized base with a few long setæ, and an apical thin-skinned, cylindrical piece which is entirely filled by an enlargement of the trachea. These filaments are undoubtedly organs of respiration. A pair of similar, but smaller formations are found on the posterior edge of the prothorax (figs. 2, 3, 4), and another pair on the posterior edge of the first abdominal segment. I believe that they correspond morphologically to the filaments on the larva of *Berosus*[1] which are not direct formations from the spiracle, but developments from the integument near the spiracle, provided with very strong tracheæ. In *Berosus* the spiracles are small but easily seen, while in *Hydroscapha* they are so reduced that even the spiracle opening cannot be seen, and only some of the very fine tracheæ of the spiracles which reach out to the surface are visible. The filaments of *Hydroscapha* resemble greatly the peculiar flattened hairs at the edges of the segments (fig. 3), but whether or not they really are to be regarded as modified hairs may be disputable. The tenth abdominal segment is directed downwards and carries two pencil-shaped appendices (*pap* fig. 7). Ventrally it is developed as a sucker (*su*).

The systematic position of *Hydroscapha* has been much discussed but the larva has hitherto not been known, and, its discovery by Messrs. Schwarz and Barber is therefore very important.

The entire larval structure shows that *Hydroscapha* must be referred to the Hydrophilidæ as a new subfamily, the Hydroscaphinæ, closely allied to the small, remarkable subfamily, Limnebiinæ, which has recently been defined by A. d'Orchymont.[2]

[1] Described by Schiödte in "de metamorphosi eleutheratorum observationes," Naturh. Tidskr. 3 Ser., vol. 1, 1862, p. 213, pl. v, vii.

[2] Contribution a l'étude des larves Hydrophilides, "Annales de biologie

The Hydroscaphinæ agree with the Limnebiinæ (represented by *Ochthebius pygmæus* F., (figs. 10–17) in many important characters. They have the same general shape of the body, downward bent head, broad gula (*gu*, figs. 6, 17), the same number of ocelli, exactly the same unusual shape of all the mouth-parts (figs. 5, 6, 10, 11, 12, 16, 17), the same deeply curved hypostoma (*h* figs. 6, 17), homologous processes on the last abdominal segment (figs. 7, 14), and similarly formed legs (figs. 8, 13). But the two larva-types differ in the antennæ which are very short in the Hydroscaphinæ (fig. 5), and rather long in the Limnebiinæ (fig. 16). The Hydroscaphinæ lack the clypeus (fig. 5) which is distinctly developed in the Limnebiinæ (fig. 16). The Hydroscaphinæ have no spiracles while the Limnebiinæ have well developed circular spiracles (fig. 15) laterally placed on the mesothorax and on the first eight abdominal segments. The Hydroscaphinæ have the above described filaments on the prothorax, and the first and the eighth abdominal segments, but no cerci on the ninth. The Limnebiinæ, on the other hand, have not these filaments, but have cerci on the ninth abdominal segment (*cer*, fig. 14). It should be noted, however, that the characters of the last abdominal segments in these two forms seem so similar that it is difficult not to consider them homologous. The true explanation may be that the first abdominal segment in *Hydroscapha* has become obliterated under the strongly developed thorax and that thus what I have cautiously determined in this larva as the first abdominal segment is really the second and that the filaments described as belonging to the eighth abdominal segment belong to the ninth, and that what has been described as the ninth and tenth abdominal segments is merely the divided tenth segment. The absence of the spiracles in *Hydroscapha* makes the interpretation very difficult but the arrangement of the spines and sensory punctures makes it evident, that if any segment is absent it must be the first; it is however possible that it is the eighth and ninth segments which have become amalgamated.

It is worth noting that the larvæ of the Limnebiinæ and the Hydroscaphinæ are very similar to the larvæ of the small Staphylinidæ of the *Tachinus-Tachyporus* group. In fact these three forms seem to be more closely related to each other than the small Staphylinids are to the normal Staphylinid type and than the Limnebiinæ and the Hydroscaphinæ are to the typical Hydrophilidæ.

All figures are camera lucida drawings by the author.

EXPLANATION OF PLATES XVII AND XVIII.

a, antennal ring; *b*, basal joint of the antenna; *c*, clypeus; *ca*, cardo; *cer*, cercus; *co*, condyle of the mandible; *cs*, clypeal suture; *cx*, coxa; *e*, exterior angle of front; *ecr*, epicranium; *ep*, epistoma; *es*, epicranial suture; *f*, front; *fe*, femur; *fi*, filament; *fo*, fossa of the mandible; *fs*, frontal suture; *g*, galea; *gu*, gula; *h*, hypostoma; *ha*, hook-shaped appendix of last abdominal segment of *Ochthebius* larva; *i*, interior angle of front; *l*, stipes labii; *la*, lacinia; *li*, ligula; *lm*, lacinia mobilis mandibuli; *lr*, labrum; *m*, mentum; *mc*, connecting lobe between maxilla and submentum; *md*, mandible; *mo*, molar part of the mandible; *oc*, ocellus; *p*, posterior angle of front; *pap*, pencil-shaped appendix of last abdominal segment of the *Hydroscapha* larva; *sm*, submentum; *st*, stipes maxillæ; *su*, sucking portion of last abdominal segment of the *Hydroscapha* larva; *t*, terminal part of the mandible; *ta*, tarsus; *ti*, tibia.

Fig. 1, *Helodid.* [Possibly *Scirtes* n. sp.] Lateral view of the larva; antennæ broken in the specimen. (The natural size of the larva is 5 mm.)

Fig. 2, *Hydroscapha natans* Lec. Dorsal view of the larva. (The natural size of the larva is 1.5 mm.)

Fig. 3, *Hydroscapha natans* Lec. Larva. Prothoracic filament; leaf-shaped hairs; and a long seta.

Fig. 4, *Hydroscapha natans* Lec. Lateral view of the larva.

Fig. 5, *Hydroscapha natans* Lec. Larva. Dorsal view of the head.

Fig. 6, *Hydroscapha natans* Lec. Larva. Ventral view of the head.

Fig. 7, *Hydroscapha natans* Lec. Larva. Ventral view of the end o abdomen.

Fig. 8, *Hydroscapha natans* Lec. Larva. Left mesothoracic leg.

Fig. 9, *Hydroscapha natans* Lec. Larva. Left mandible seen partly from the buccal cavity, partly from below.

Fig. 10, *Ochthebius pygmæus* F. Larva. Right mandible; dorsal view.

Fig. 11, *Ochthebius pygmæus* F. Larva. Left mandible; ventral view.

Fig. 12, *Ochthebius pygmæus* F. Larva. Left mandible from the buccal cavity.

Fig. 13, *Ochthebius pygmæus* F. Larva. Left mesothoracic leg.

Fig. 14, *Ochthebius pygmæus* F. Larva. End of the abdomen from the side and a little from above to show both abdominal hooks.

Fig. 15, *Ochthebius pygmæus* F. Larva. Lateral view. (The natural size of the larva is 3.5 mm.)

Fig. 16, *Ochthebius pygmæus* F. Larva. Dorsal view of the head.

Fig. 17, *Ochthebius pygmæus* F. Larva. Ventral view of the head.

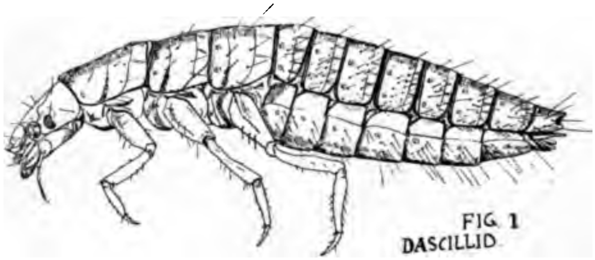


FIG. 1
DASCILLID

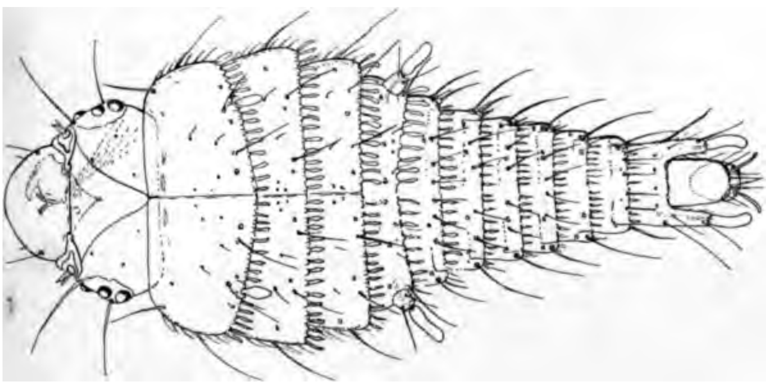


FIG. 2
HYDROSCAPHA.

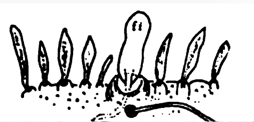


FIG. 3

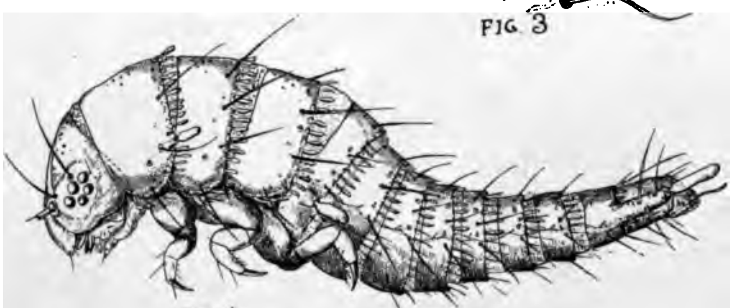


FIG. 4
HYDROSCAPHA

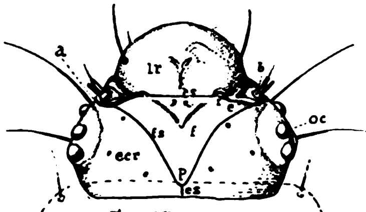


FIG. 5 HYDROSCAPHA

FIG 6 HYDR.

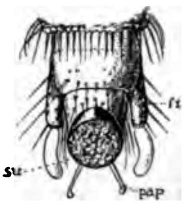


FIG. 7 HYDR.

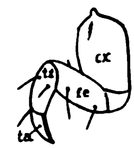


FIG. 8 HYDR.

FIG. 9 HYDR.

FIG. 10 OCHT.

FIG. 11

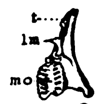


FIG. 12

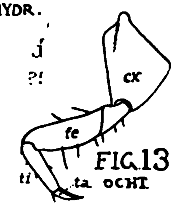


FIG. 13 OCHT

FIG. 14 OCHT.

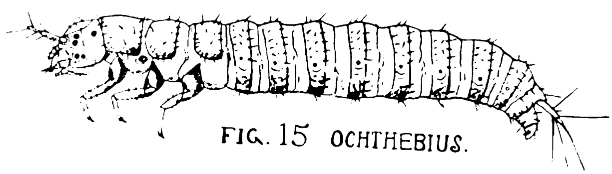


FIG. 15 OCHTHEBIUS.

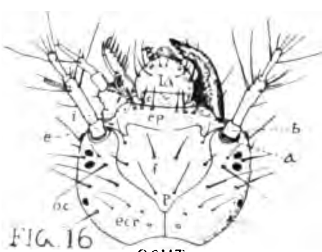


FIG. 16 OCHT.

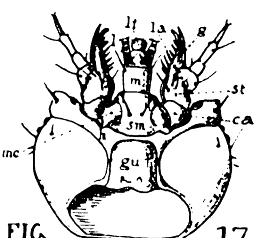


FIG. 17. OCHT

NOTE ON RHIPIDANDRI—A CORRECTION.[1]

By E. A. Schwarz and H. S. Barber, *Bureau of Entomology.*

An injustice seems to have been done to Motschulsky's memory by the junior writer in his former notes on this group (Proc. Ent. Soc. Wash., 1913, vol. xv, p. 189), and by other writers also, owing, probably, to the similarity of the names *Xyloborus* and *Xyleborus.* Thus Gemminger and Harold 1872 (Cat., p. 2685), Hagedorn 1910 (Coleopt. Catal. Junk, Ipidæ, p. 101), Barber 1913 (Proc. Ent. Soc. Wash., xv, p. 189–190) and Kleine 1914 (Berl. Ent. Zeitsch., vol. 58, 1913, p. 160) have all been wrong in considering that he had described his species as a Scolytid, and in failing to recognize his generic name. The only writer who seems to have noticed the distinction seems to be Arrow 1904 (Ann. Mag. Nat. Hist. (7), vol. 14, p. 30–33) who for some reason did not make use of Motschulsky's generic name. It is also worthy of record in this connection that cotypes of some foreign species have been added to our National Collection. We append some omitted or subsequent bibliographical references for addition to the list of notices previously given.

The name *Xyloborus* appears among Heteromerous genera in the Dejean Catalogue (1833, p. 201, and 1837, p. 222) with an undescribed species from Buenos Ayres and is therefore a *nomen nudum,* but Motschulsky in 1858 described a related species, *crenipennis,* from Burma using the generic name of Dejean and referring to the South American species, thus validating the generic name, for which his species automatically becomes the type. That he was dealing with a Heteromerous instead of with a Scolytid genus is evident from the remarks following his specific diagnosis and which also mention some generic characters. Moreover the name *Xyleborus* was not used for the genus in the latter family until six years later. *Xyloborus* is thus an older name than any of the other generic names of the group, if *Eledona* be excluded, but it is necessary to examine the status of the genus in which the still older species (*flabellicornis*) had been placed. Sturm, 1826, evidently intended to write *Xyletinus* instead of *Xylotinus* on page 59 of his Catalogue, for on page 206, and on plate 1, figure 7, the name is correctly spelled. This typographical error should not be perpetuated to supersede *Rhipidandrus* LeConte 1857. The type of *Xyletinus* Latr. 1890, cannot be *pectinatus* as stated by Westwood, for it is not one of the three originally included species. Two of the three are now listed in *Lasioderma* leaving only *bucephalus* Illiger as the logical type.

[1] Presented at meeting of June 4, 1914.

Cotypes and other specimens of some of the foreign species have been received recently by the National Museum from the British Museum, through the kindness of Mr. Arrow, and from Mr. H. Gebien and M. René Oberthür, as follows:

Rhipidandrus mexicanus Sharp cotype. Yzabel, Guatemala (Sallé).
Rhipidandrus sulcatus (Gorham) cotypes. St. Vincent, W. I. (H. H. Smith).
Eutomus cornutus (Arrow) cotypes. St. Vincent, W. I. (H. H. Smith).
Eutomus cornutus (Arrow). Guadeloupe, (one of Sallés specimens which were called by him *micrographus*).
Eutomus walkeri (Waterhouse). Matabello Isl. (A. R. Wallace).
Eutomus sp. (possibly ? *peruvianus* Cast.). Paraguay.
Xyloborus crenipennis Mots. Andamans (Roepstorff).
Xyloborus nudus (Gebien) cotypes. Banguey, B. Borneo.
Bolitolaemus fomiticola Geb. cotype. East Usambara, Deremas. (Eichelbaum).

Gen. nov.? Brunnei Borneo. Two damaged specimens of an inconspicuous form looking like a robust Cioid but having one of the mandibles bifid so as to receive the point of the other, and having 11-jointed antennæ with 5-jointed club preceded by 4 small joints, were sent by M. René Oberthür, but the material is insufficient for dissection and careful study. Superficially they appear to form an interesting connecting link between the Cioidæ and Rhipidandrini, which well deserves closer examination.

A number of references to members of this group have been omitted from the former chronological bibliography. The following may be added to the list:

1833. DEJEAN (Cat. Coleop., p. 201) lists *Xyloborus costatus* Dej. from Buenos Ayres, not far from *Eledona* in the series he calls "Taxicornes" most of which are now included in the Tenebrionidæ. This species has never been described and the genus was invalid until used by Motschulsky in 1858. Among the Xylophages (Ipidæ) (l.c., p. 306) Dejean has placed *Eutomus micrographus* Lacordaire, which remained a *nomen nudum* until validated by Lacordaire in 1866.

1837. DEJEAN (Cat. Coleop., p. 222 and 306) same as in 1833.

1886. CHAMPION (Biol. Cent. Amer. Coleop., vol. IV, pt. 1, p. 223) excludes "*Eutomus* Lac. (*Rhipidandrus* Lec.)" from the Bolitophagides on account of the 4-jointed tarsi, and antennal structure.

1895. BLANDFORD (Biol. Centr-Amer. Coleop., vol. IV, pt. 6, p. 118) refers to the exclusion of the Eutomides from the Scolytidæ and assignment to the vicinity of *Cis*.

1911. TREDL AND KLEINE (Uebersicht über die Gesamtliterature der Borkenkäfer, Beilage zu den Ent. Blättern, 7 Jrg., p. 45) wrongly include *Xyleborus crenipennis*, under the Scolytids described by Motschulsky.

1912. Pic (Coleop. Cat. Junk. Anobiidæ, p. 48) still includes *flabellicornis* Sturm as a valid species in *Xyletinus*.

1914. Kleine (Berl. Ent. Zeits., 58, 1913, p. 160) lists *crenipennis* Mots., from the East Indies as a valid species in the Ipid genus *Xyleborus*.

1914. Dury (Journ. Cincinnati Soc. Nat. Hist., p. 168) describes *Rhipidandrus fulvomaculatus* n. sp., from Alabama and Florida, which is apparently a small species of *Eulomus*.

1914. Dury (Journ. N. Y. Ent. Soc., xxii, p. 173) defines the Cioidæ so as to exclude "the Rhipidandrinæ which form a tribe in the family Tenebrionidæ."

1914. Leng and Mutchler (Bull. Am. Mus. Nat. Hist., xxxiii, pp. 461–462) cite the two West Indian species under three generic and four specific names under which they have been recorded by Sallé, Arrow and Gorham.

(1914? Gebien in a letter mentions descriptions of new forms in this group that were to appear shortly in the Bulletin of the Sarawak Museum, but the writers have not yet seen this journal.)

The position of the Rhipidandri still appears very vague. Sharp was probably mistaken about the front tarsal joints, for the writers can find but four joints, as in the Cioidæ, in all tarsi of *Rh. flabellicornis*, *Eu. cornutus*, *peninsularis* and *fuscomaculatus*, while the tarsi of *Eledona* are typically heretomerous. The value of this character may have been overestimated The antennæ do not differ essentially, and it is interesting to note that Sharp & Muir (Tr. Ent. Soc. Lond. 1912, p. 3, p. 618 and 619) have tentatively grouped a number of "Heteromerous" families with the *Cioidæ* in the superfamily *Cucujoidea*, but say the ædeagus in *Cis* is not similar to anything else. The Rhipidandri appear to be intermediate between *Eledona* and the Cioidæ in many of their characters and are probably worthy of family rank, but the undescribed genus from Borneo, above referred to, seems to link them more closely with the latter than does *Bolitolæmus* to *Eledona*. It is to be regretted that no larvæ of any member of this group are at hand. The only description of the immature form is by Friedenreich and has been abstracted by Arrow.

At the meeting of November 1, 1914 a special committee consisting of A. Busck, E. A. Schwarz and N. Banks presented the following which was ordered printed.

THEODORE N. GILL.

There is no need in this brief notice to attempt any eulogy of Dr. Gill. As one of the greatest naturalists of the age his accomplish-

ments and connection with various scientific societies are known to all throughout the world. We wish more especially to record his relations with our Society which date back more than twenty-five years, when upon invitation of a member he attended one of the meetings. He was so interested in the discussion, that in 1891 he became an active member, and thereafter the Society was highly honored by his regular attendance. He read but few formal papers before the Society, but very frequently took part in the discussions, and with his inexhaustible knowledge of taxonomy and comparative anatomy was able to present the broader view of many questions. His extemporaneous remarks were often so thorough and extensive as to constitute a general zoological review of the entire matter. Among the more important matters touched upon by Dr. Gill may be mentioned the following:

The Larva of Insects, An Intercalated Stage. Ent. Soc. Wash. Pro., vol. II, p. 304, 1892.

On a Remarkable New Family of Crabs from the Coast of Coromandel at a Depth of 150–200 Fathoms, Proposing new generic name *Retroplumа* and the new family *Retroplumidæ*. Ent. Soc. Pro., vol. III, p. 182, 1894.

Relative Value of Different Groups of Animals from the Faunistic Standpoint. Ent. Soc. Pro., vol. IV, p. 194, 1897.

On the Evolution of Genus Making. Ent. Soc. Pro., vol. IV, p. 345, 1898.

Note on Micropterous Island Insects. Ent. Soc. Pro., vol. IV, p. 488, 1898.

On the Fauna of Hawaii. Ent. Soc. Pro., vol. IV, p. 491, 1898.

On the Character of the Philippine Island Fauna. Ent. Soc., Pro. vol. VI, p. 174.

On Taxonomic Groups. Ent. Soc. Pro., vol. XIII, p. 181.

On Secondary Sexual Characters. Ent. Soc. Pro. vol. XIV, p. 204.

Dr. Gill's uniform kindness in aiding his fellow members not only in zoological but in linguistic and bibliographic matters will never be forgotten by the many of us who personally benefited thereby. No one will ever know how many generic and other names credited to various entomologists really originated with Dr. Gill.

Dr. Gill's genial presence added greatly to the scientific and social success of our meetings and the loss of our most notable member will be deeply felt by all of us.

NOTES ON THE DIPTEROUS GENUS CHYROMYA R-D.

By J. R. Malloch, *Urbana, Ill.*

This genus has undergone several nomenclatorial changes since 1830 as indicated by the synonymy given below.

Chyromya R-D., Essai Myode., p. 621 (1830).
Pelithophila of authors, not Hagenbach, Symbol. Faun. insect. Helv., p. 48, (1822).
Lisella R-D., Essai Myod., p. 649 (1830).
Sapromyza part Fallen, Zetterstedt and Meigen.
Scyphella R-D., Essai Myod., p. 650 (1830).
Thyrimyza Zetterstedt, Dipt. Scand., vol. 6, p. 2336 (1847).

In addition to these we have the misspelled names *Chrymomyia* and *Peletophila* by Becker[1] and the emendation to *Chiromyia* by Melander[2] following Scudder.[3]

The name *Pelethophila* cannot be used as the only species originally included in the genus is a true *Psila* (*fimataria* Linne).

The position also of the genus has been subject to some changes. The older authors placed it in Sapromyzidæ while some recent authors have placed it in Opomyzidæ. The latest arrangement regulates it to Opomyzinæ a subfamily of Geomyzidæ.

The generic characters are as follows: Post-vertical bristles convergent; ocellar bristles divergent; ocellar triangle and orbits poorly defined; usually 3 pairs of orbital bristles, the anterior pair convergent; antennæ small, the third joint not elongated, apically rounded, arista almost bare; face slightly receding; cheeks about half as high as eye, vibrissæ weak; proboscis fleshy; palpi normal. Thorax with 2–4 pairs of dorso-central bristles and distinct and rather numerous discal setulæ; mesopleura with usually 2 bristles; sterno-pleura with 1 bristle. Legs without preapical bristle. Wings with costa twice broken; auxilary vein indistinct, incomplete, or joining costa; costa unspined; discal cell elongate; outer cross vein beyond middle of wing; anal cell complete; anal vein reaching almost or quite to margin.

Synopsis of North American Species of Chyromya.

1. Fore and hind femora of male much swollen; large species, 3–3.5 mm. *femorella*
   Fore and hind femora of male not swollen.............................2
2. Thorax with 4 pairs of dorso-central bristles..........................3
   Thorax with 2–3 pairs of dorso-central bristles.......................4

[1] Zeitschr. für Syst. Hymen. u. Dipt., vol. 4, 1904, p. 129.
[2] Jour. N. Y. Ent. Soc., vol. 21, p. 300 (1913).
[3] Nomen. Zool.

3. Larger species, 2–3 mm.; scutellum with setulæ in addition to the 4 marginal bristles .... *flava*
   Smaller species, 1.5–1.75 mm.; scutellum with only the 4 marginal bristles .... *minima*
4. Last joint of mid tarsi of male black; of the female slightly brownish .... *nigrimana*
   Last joint of mid tarsi yellow .... *concolor*

Chyromya femorella Fallen.

Sapromyza femorella Fallen, Dipt. Suec., Ortalid. 34, 15 (1820).

This species like all the others in the foregoing table except *nigrimaria* is yellow in color with a black ocellar spot. The mesonotum has four pairs of strong dorso-central bristles and about six irregular rows of setulæ between them. The femora of the female are less distinctly thickened than those of the male but still appreciably thicker than those of *flava*.

I have seen both sexes of this species from Algonquin, Ill., W. A. Nason. Male swept from low herbage along creek; most of the females taken on windows, but a few on flowers. May to June.

Chyromya flava. Linne.

Musca flava, Linne, Fauna Suec. 1869 (1761).

Scyphella flavicornis R-D., Essai Myod., p. 650, sp. 1 (1830).

I have not as present before me specimens of this species, but believe that Professor Melander has correctly recorded it as occurring in America.

I have taken the species commonly in Scotland on windows where it occurred along with *lutea*. The latter is distinguished from *flava* by the black third antennal joint and very probably occurs in America also.

Chyromya minima Becker.

Peletophila minima Becker, Zeitschr. fur. Syst. Hymen. u. Dept., vol. 4, p. 133 (1904).

Becker describes this species as follows: "Matt, blassgelb. Thorax mit 4 deutlichen Dorso-centralborsten und dazwischen unregelmassig in ca. 4 Reichen gestellte Akrosti-kalborsten. Schildchen ausser den 4 Randborsten nackt. Borsten und Haare auf dem Thorax und Kopf gelb. Augen querliegend. Punctaugenhocker nicht geschwarzt. Hinterrücken und Hinterlieb gelb; bei den Manichen ist derselbe, namentlich gegen das Endehin deutlich, bei den Weibchen weniger deutlich, fein schwarz behaart. Schenkel nicht verdickt. Flugel wie bei den übrigen Arten. 1½–1¾ mm. lang."

Professor Melander records this species from Washington and California.[1]

[1] Jour. N. Y. Ent. Soc., vol. 21, p. 300 (1913).

I have not seen the species. The meso-pleura is stated by Melander to be "not setulose," a character not mentioned by Becker.

Chyromya nigrimana n. sp.

Male: Yellow, and slightly shining. Head whitish yellow, cheeks almost white; arista brown, base yellow; ocellar region black, Pleuræ whitish. Legs yellow, last tarsal joint of middle legs black. Wings clear, veins yellow. Halteres yellow. Bristles and hairs yellow.

Frons one-third the width of head at vertex, distinctly narrowed anteriorly; 3 pairs of orbitals present; of almost equal length; center stripe with a few microscopic surface hairs; arista almost bare; cheek at middle half as high as eye; eye as high as long; its long axis diagonal to the longitudinal line of body. Mesonotum with 2 pairs of strong and usually 1 pair of weak dorso-centrals; about 8 rows of setulæ between dorso-centrals; mesopleura with a few weak hairs in addition to the usual bristles; scutellum with 4 marginal bristles. Hypopygium large and knob-like. Legs without bristles, except on the postero-dorsal surface of fore femora. Wings with inner cross vein at two-fifths from apex of discal cell; penultimate section of fourth vein about one-fourth the length of ultimate section and subequal with ultimate section of fifth.

Female: Similar to male except that the last joint of mid tarsus is slightly brownish instead of black. Abdomen slightly pointed at apex.

Length: 1.5 mm.

Type locality: Urbana, Ill., May 20, 1914 (C. A. Hart and J. R. Malloch). Taken by sweeping vegetation along the bank of Salt Fork at the Fair Gounds.

Paratypes: St. Joseph, Ill., May 3–17, 1914 (J. R. Malloch). On bank of Salt Fork.

Chyromya concolor n. sp.

Male and *female:* Entirely yellow with the exception of the black ocellar spot.

Differs from the preceding species in having the eyes more elongate and nearly in line with the long axis of the body; the dorso-central bristles stronger, the third pair generally distinct, and the inner cross vein nearer to middle of discal cell (in type at middle).

Length: 1.5–1.75 mm.

This species is evidently very close in general appearance to *minima* but unless Becker erred in his description it cannot possibly be that species.

Type locality: Monticello, Ill., June 21–28, 1914 (C. A. Hart and J. R Malloch). Taken by sweeping vegetation on bank of Sangamon River.

Paratypes: Muncie, Ill., May 24, 1914 (C. A. Hart and J. R. Malloch); Algonquin, Ill., June 1–10, 1894 (W. A. Nason).

HABITS OF SOME TACHINIDAE.

By R. C. Shannon, *Bureau of Entomology.*

It appears from recently collected Tachinids that nocturnal habits may be more common in this family than we have supposed. Mr. Walton has spoken at a previous meeting of the society of *Eutrixa exile* Coq. as probably being nocturnal, he having seen two specimens from Ithaca, N. Y., collected at light and knowing that they are parasitic upon nocturnal beetles (*Lachnosterna*). Another specimen of this species was taken at light at Plummer's Island, Maryland, in April, 1914. There are three specimens in the National Collection which were bred from adult *Lachnosterna arcuata* by Mr. Theodore Pergande in March, 1895. Other nocturnal Tachinids have recently been collected at light at Forest Glen, Maryland, by Mr. Otto Heidemann. One specimen is *Cryptomeigenia theutis* Walker, a well known parasite of adult *Lachnosterna*, and four specimens are of an apparently new species of *Neophyto*, which will be described later by Mr. Walton. This latter species is probably parasitic upon some nocturnal beetle, since its close relatives have such habits. It may be that this species hides during the day, which would perhaps account for it remaining unknown hitherto. The nocturnal habit of these flies is clearly an adaptation to the nocturnal habit of their hosts.

The genus *Trichopoda* has been known to be parasitic on Hemiptera and recently has been bred on various occasions. Last year several parasitized adults of the Coreid, *Metapodius terminalis* were collected near Washington by Mr. Frederick Knab and from one of these an adult *Trichopoda* was bred while another on dissection disclosed a larva in the base of the abdomen. A parasitized specimen of *M. instabilis* was found by the writer at Dead Run, Fairfax County, Virginia, May 2, of this year and from it a fine specimen of Trichopoda was bred. The larva left its host and pupated on May 15, while the imago issued on the 29th. Parasitized specimens can be recognized at a glance since the externally laid egg is white and is in strong contrast with the body color of the host. Often more than one egg is laid upon a single victim, Mr. Knab having in one case seen as many as five. They are usually laid upon either the head or thorax, above or below, but sometimes are even attached to the tegmina.

Another genus of Tachinids has been bred from a different genus of Hemiptera. A specimen of *Reduviolus roseipennis* Reuter, in which the abdomen was swollen much beyond normal size, was found on Plummer's Island, Maryland, May 10, 1914, and was placed in an isolation vial, where, about a week later, it was found dead with a dipterous puparium beside it. This

INDEX TO VOLUME XVI.

Actual date of publication
December 30, 1914.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

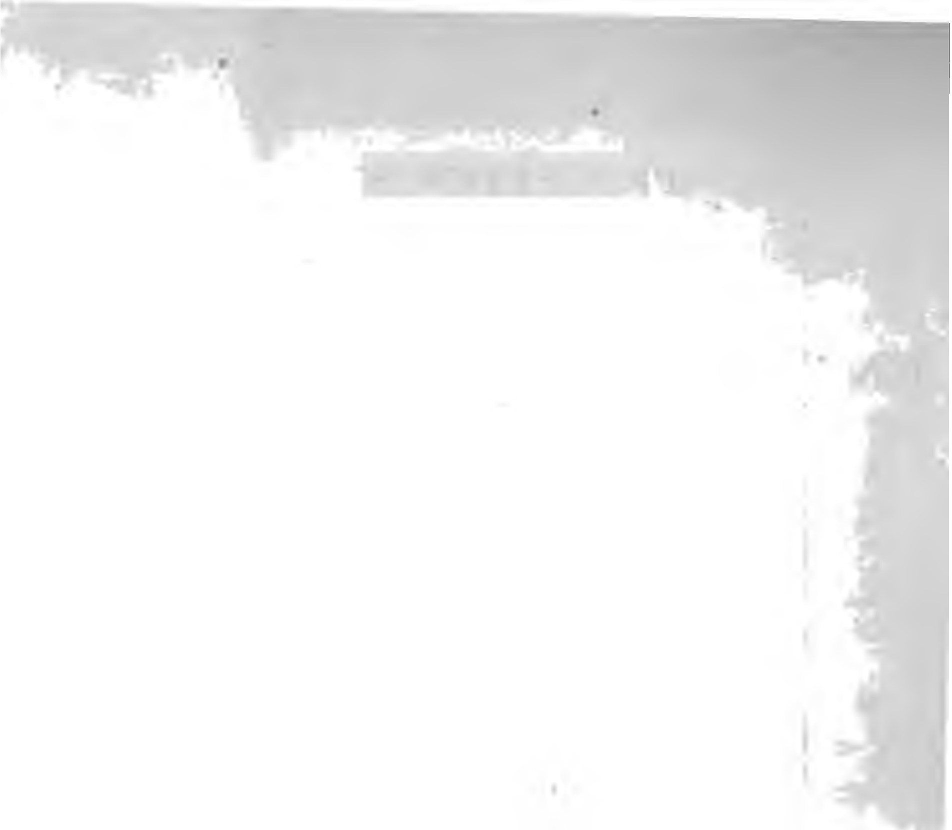
WASHINGTON

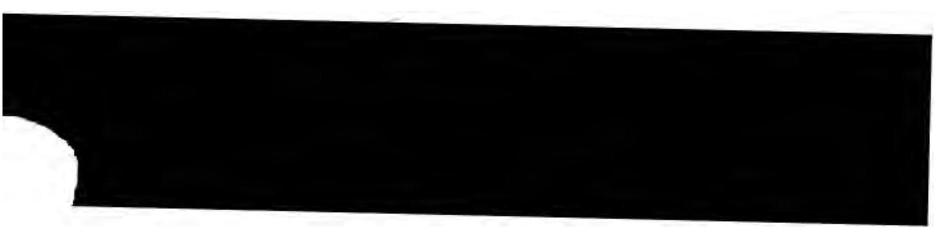
Volume XVII

PUBLISHED BY THE SOCIETY,
QUARTERLY

BALTIMORE, MD. WASHINGTON, D. C.

1915





CONTENTS OF VOLUME XVII

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVII 1915 No. 1

Two Hundred and Seventy-Eighth Meeting,

June 4, 1914.

The 278th regular meeting of the Society was entertained by the bachelor members at the Sængerbund Hall, June 4, 1914. There were present 20 members and two visitors.

The following paper was presented:

The Temperature of the Honey Bee Cluster as Modified by External Conditions .... Dr. E. F. Phillips[1]

Under the head of Notes and Exhibition of Specimens, the following were presented:

Note on Rhipidandri—a Correction..... E. A. Schwarz and H. S. Barber[2]

CAPTURE OF CALLICERA JOHNSONI HUNTER.

By C. T. Greene, *Bureau of Entomology.*

A female specimen collected at Falls Church, Va., April 22, 1914, by the writer. The specimen was resting on the ground. The altitude at the point of capture is about 350 feet above sea level, the highest point at Falls Church is about 400 feet above sea level.

[1] Withdrawn from publication.

[2] Published in these Proceedings, vol. xvi, no. 4.

ON POSSIBLE POISONING OF INSECTIVOROUS BIRDS IN THE WAR AGAINST THE GIPSY MOTH.

By L. O. Howard.

The speaker mentioned the fact that the extensive use of arsenate of lead in poisoning woodlands around Boston had given rise to rumors that many insectivorous birds were being killed by the arsenic, either by feeding upon insects that had been killed by the poison or by sucking drops of the spray from the leaves of sprayed trees before the moisture had time to evaporate. He stated that Mr. William Brewster, of Concord, had noticed in the woodlands surrounding his place that several species of birds had disappeared and that he feared it was from this cause. The speaker further stated that he had mentioned this matter on a recent Boston trip to Dr. W. M. Wheeler at the Bussey Institution, and that Dr. Wheeler had stated that in his opinion the insectivorous birds had disappeared for the reason that their insect food had been destroyed and they had simply migrated to regions where their food had not been killed by the poison sprays and was therefore normally abundant. Doctor Wheeler stated that he would send his students after class material into the regions around the Bussey Institution and that they would return with very few leaf-feeding insects. These had become very scarce since spraying had become so general. The speaker stated that he asked the agents of the Bureau of Entomology in New England to search for dead birds and to send their stomachs to Washington for chemical analysis whenever they were found. (The author of this note adds, that but one dead bird has been found by the gipsy moth agents up to late September, and that its stomach showed no trace of arsenic.)

Two Hundred and Seventy-Ninth Meeting,

October 1, 1914.

The 279th regular meeting of the Society was entertained by Mr. B. A. Schwarz in the Sængerbund Hall, October 1, 1914. There were present Messrs. Abbott, Baker, Barber, Busck, Burgess, Caudell, Crawford, DeGryse, Ely, Gahan, Heinrich, Hunter, Hutchinson, Jones, Knab, Kotinsky, Myers, Menagh, Middleton, Popenoe, Pomeroy, Sanford, Sasscer, Schwarz, Shannon, Townsend, Turner, Walton, White, Wood, members, and Messrs. J. N. Summers and Edward R. Speyer, visitors.

Mr. Busck reported for the Committee appointed to draw up resolutions in commemoration of Dr. Theodore Gill.[1]

Mr. W. H. White was elected to active membership.

At the close of the program the following visitors were called on for remarks:

Mr. Edward R. Speyer, a Carnegie student, spoke of entomological conditions in England.

Mr. John N. Summers of the Gipsy Moth Laboratory, gave a short account of his recent trip to Europe and of the conditions present in the forests where the Gipsy moth occurs.

The following papers were presented:

Reply to Criticism by Aldrich, Presented at the 277th Meeting..
Dr. C. H. T. Townsend[2]

A Destructive European Pine Moth, *Evetria buoliana*, Introduced into the United States....................................August Busck[3]

NOTES ON SOME BEES FROM VIRGINIA.

By T. D. A. Cockerell, *Boulder, Colorado.*

Mr. S. A. Rohwer has forwarded the following flower records referring to bees collected at Falls Church, Virginia. One of the females is undescribed and is herewith characterized.

VISITORS OF *Helianthus annuus coronatus.*

The following bees were taken collecting the pollen on the red sunflowers:

Halictus ligatus Say. det. Crawford.

Bombus pennsylvanicus (De Geer) Franklin det. Crawford.

Bombus impatiens Cresson det. Crawford.

Melissodes dentiventris Smith det. Cockerell. Mr. Rohwer notes that this bee visits the sunflowers in the mornings; he never took it in the afternoon.

---

[1] Published in these Proceedings, vol. xvi, no. 1.

[2] Withdrawn from publication.

[3] Withdrawn for publication elsewhere.

VISITORS OF *Phaseolus lunatus*.

The following two species are common visitors of the lima beans where they collect nectar:

Bombus pennsylvanicus (De Geer) Franklin det. Crawford.

Bombus fervidus Fabricius det. Crawford.

The following three species of *Megachile* collect pollen and are useful in cross fertilization. An especially important cross pollinator in the locality studied is the female described below.

Megachile exilis Cresson det. Cockerell.

Megachile latimanus Say det. Cockerell.

Megachile petulans Cresson.

Female. Length about 11.5 mm. Black, the tarsi slightly reddish at extreme apex, the flagellum with very obscure dark reddish spots on the joints beneath; hair of head and thorax black and white, the tuft behind wings cream-color; ventral scopa pale yellow, becoming white basally, black at extreme apex, but yellow on base of last segment; eyes dark (not green); cheeks and vertex small; vertex with black hair, clypeus with some black hair, front with black hair intermixed, face otherwise, and cheeks with white hair; clypeus and supraclypeal area shining, but closely and strongly punctured, no smooth median line on clypeus; lower edge of clypeus gently concave, with a very small median tubercle, not projecting below the margin; maxillary blades clear amber-color; first joint of labial palpi 1200 μ long, second, 975 μ, tongue extending about 1360 μ beyond labial palpi; mesothorax and scutellum densely punctured, but moderately shining between the punctures; discs of mesothorax and scutellum with black hair, but thin white hair on mesothorax anteriorly, white hair on scutellum posteriorly, and a band of dense white hair in scutello-mesothoracic suture; pleura covered with white hair; tegulæ black; wings dusky, especially apically; nervures dark; hair of legs mainly white, that on inner side of tarsi ferruginous; short joints of anterior tarsi thickened; middle and hind tarsi broadened, hind basitarsi very broad and flat; abdomen broad cordiform, shining, very finely punctured, with very narrow entire white hair-bands on hind margins of segments, that on first reduced to a fine ciliation except at sides; when the abdomen is seen from above, only a rather small amount of short black hair projects at sides; sixth dorsal segment in lateral profile short and straight, with thin black hair like that on fifth, though there is also a very delicate greyish pruinosity. Mandibles with two sharp teeth, a third truncate, and a long inner edge.

Habitat: East Falls Church, Virginia, at flowers of lima beans, along with *M. exilis* Cresson, ♂, and *M. latimanus* Say, ♀, August 9 (S. A. Rohwer). It is readily distinguished from *M. infragilis* Cresson by the 4-dentate mandibles (with the fourth or inner tooth not at all salient, merely a straight cutting edge),

and the first joint of labial palpi longer than second. From *M. relativa* Cresson by the shape of the abdomen, band in scutello-mesothoracic suture, etc. From *M. mendica* Cresson by the black hair on dorsum of sixth abdominal segment, the entire bands, etc.

Two Hundred and Eightieth Meeting,

November 5, 1914.

The 280th regular meeting of the Society was entertained by Dr. L. O. Howard, in the Sængerbund Hall, November 5, 1914. There were present Messrs. Abbott, Baker, Barber, Böving, Busck, Caudell, Cory, Craighead, Crawford, DeGryse, Duckett, Ely, Fisher, Gahan, Greene, Howard, Hunter, Hutchinson, Knab, Kotinsky, McIndoo, Marlatt, Popenoe, Rohwer, Sanford, Sasscer, Schwarz, Shannon, Simanton, Snyder, Townsend, Turner, Walton, Webb, White and Wood, members, and Dr. J. C. Bradley, Messrs. Dwight Isely, H. G. Champion and E. W. Rust, visitors.

At the close of the regular program the following visitors were called on for remarks:

Mr. Champion, a Carnegie student, spoke of the scientific societies at Oxford, and also recounted some experiments with small mutillids parasitic on cicindellid larvæ.

Dr. J. C. Bradley of Cornell University spoke of certain entomological activities now under way in New York State.

The following papers were presented:

Remarks on Dialeyrodes..............A. L. Quaintance and A. C. Baker[1]
Notes on Some of our Meetings............................S. A. Rohwer[2]

---

[1] Withdrawn for publication elsewhere.
[2] Withdrawn from publication.

ON ACROCERCOPS STRIGIFINITELLA CLEMENS.

By Carl Heinrich, *Branch of Forest Insects, U. S. Bureau of Entomology.*
AND
Rev. J. J. DeGryse.

HISTORICAL.

This interesting microlepidopteron was first described by Clemens in 1860 under the name *Gracilaria strigifinitella* and again by Chambers in 1872 as *G. duodecemliniella.* In 1875 Chambers redescribed it as *Ornix quercifoliella,* appending the following note: "a single specimen received from Miss Murtfeldt who informs me that the larva curls down the edge of oak leaves (sic!). In its earlier stages it is probably a leaf miner." Busck in 1902 established the above synonomy and referred the species to Walsingham's genus, *Dialectica* with the further information that he had reared a single specimen from oak leaves collected at Washington, D. C. Meyrick has since proved *Dialectica* to be a synonym of *Acrocercops* and has placed *strigifinitella* in Group C (Gen. Ins. Fasc. 123) of that genus with another North American species, a single European and several Australian forms.

In the spring of 1913 one of the authors (Heinrich) found at Falls Church, Va., a lepidopterous larva mining the midribs of chestnut, chinquapin and oak leaves. Adults reared from these and from similar larvæ in leaves of *Fagus americana,*[1] were determined by Mr. Busck as *Acrocercops strigifinitella.* Further investigations were continued by the authors during the past summer. Chestnut appears to be the favorite food plant and during mid-summer the work of the species is very common, few of the young leaves escaping infestation, some bearing as many as four separate mines. When the proper food supply is abundant, however, there is rarely more than one or two to the leaf. There are a number of generations with considerable overlapping so that larvæ are to be found any time from May till well on into October. The first larval brood appears in spring as soon as the leaves are formed. During July and August the dominant period in the seasonal life of the species is reached. Towards fall there is a gradual diminution in numbers, and during October a partial dying out of the species, due in great measure to the scarcity of new leaves which are necessary to the successful maturing of the larvæ. In the neighborhood of Washington, D. C., the last larval brood appears early in October. The manner in which the species overwinters has not been definitely

[1] Elkmont Tenn., T. E. Snyder, U. S. Bur. of Ent., Collector.

determined but our observations lead to the belief that the few larvæ which are able to feed up during October, make their cocoons before the leaves fall and pass the winter as pupæ, developing into moths early in spring.

SYNONOMY.

Gracilaria strigifinitella, Clemens—Proc. Acad. Nat. Sci. Phil., 6, 1860.
Gracilaria duodecemliniella, Chambers—Can. Ent., IV, 11, 1872.
Ornix quercifoliella, Chambers—Cin. Quart. Jn. Sci., II, 116, 1875.
Dialectica strigifinitella, Busck—Proc. Ent. Soc. Wash., V, 3, 195, 1903.
Acrocercops strigifinitella, Meyrick—Gen. Ins. 123 Fasc., 17, 1912.

EGG.

The eggs (pl. 1, fig. 3) are laid singly on the under surface of the leaves, usually near the base and between the branching ribs. They average about 0.1 mm. in length, are elliptic in circumference, flattened below and convex above, shining pearly white and minutely faceted. The period of incubation for those specimens under observation was from 4 to 6 days.

LARVA.

Upon emergence from the egg the young larva makes a short irregular linear mine just beneath the cuticle of the leaf on the under side (pl. 2, fig. 4). In this mine it passes the first two instars during both of which it is of the flat specialized gracilariid type (pl. 2, fig. 5), whitish, without legs, abdominal feet or discernible body tubercles or setæ. The head-capsule (pl. 3, figs. 1, 2) is wedge-shaped with the greatest width just forward of the tentorial bridge; the diameter of occipital foramen at dorsal extremity of hind margin $\frac{1}{2}$.[1] The frons extends a trifle more than $\frac{1}{2}$, the frontal ridges diverging slightly to the juncture of the tentorial arms, and then converging to form a short bridge (*ob*) with the hind margin which projects into head-capsule $\frac{1}{4}$. The adfrontal sclerites are fused with the frontal ridges. The tentorial bridge is a trifle less than $\frac{1}{3}$ in length, straight and thickened somewhat in the middle; the upper attachment of tentorial arms well back of middle of frontal ridges. Ocelli dorsally placed, well back from base of antennæ; strongly but unevenly pigmented; lenses absent. Antennæ 3-jointed, the basal joint short and only seen under oil immersion; the larger papilla on second joint extending nearly to apex of antenna, papillæ otherwise normal; setæ absent. Post-labrum approximately tri-

[1] In the description of the head-capsules all measurements are expressed in proportion to the greatest width of the head.

angular with apex forward of the median incision of the labrum. Labrum (pl. 2, fig. 2) rather narrow, with two setæ-bearing tubercles; median incision deep and strongly chitinized on the edges; between these and extending outwardly a small oval epipharyngeal shield (*es*) visible only under oil immersion; distal edge of median incision serrate. Mandible (pl. 2, fig. 1) flat; three-toothed; distal fourth of median edge projecting and dentate. Labium (pl. 2, fig. 3) thrust well forward, spoon-like with distal margin serrate and anterior concavity rounded; no labial palpi; under oil immersion a well defined stipes; labium extending far back into head, with no apparent articulation between mentum and sub-mentum. Salivary ducts plainly visible and joining to the front to form what appears to be a very rudimentary spinneret, seen only under oil immersion. Hypopharynx finely haired on forward portion only. Maxillæ with palpus absent; origin of lacinia in palpiger not defined; lacinia bearing two bristle-like digiti; no distinct joint between palpiger and stipes, the latter considerably elongated; cardo small and triangular. Triangular plates of hypostoma (pl. 3, fig. 1) small and separated by slightly less than ½. On the ventral side of the head-capsule approximate to each antennal ring is a pair of hairless tubercles. Otherwise the head-capsule is smooth. Length of larva before first moult 0.75 mm.; before second moult 1.25 mm.

After the larva has moulted for the second time it bores into one of the branching ribs which it mines during the whole or greater part of the third instar. The later instars, two of which we are able to account for, are passed in the mid-rib within which the larva mines (pl. 1, fig. 5) up or down, as the case may be, and from which it emerges when ready to spin its cocoon. As a rule the path of the mine is upward, the larva emerging from the upper side of the rib near the tip (pl. 1, fig. 2). In some cases where the leaf is too small for the mid-rib to afford sufficient nourishment, the larva continues to mine from there into the fleshy part of the leaf making a large irregular blotch (pl. 1, fig. 1) quite similar to that of *Mnemonica*. This habit however is quite abnormal.

The first two instars are the only ones in which the larvæ are of the flat gracilariid type.[1] The third instar larva is transitional between these and the typical cylindrical gracilariid form of the following instars, but with pronounced affinities to the latter. It is cylindrical, has well developed spinneret, labial and maxillary palpi and appreciable body setæ. There are, however, no noticeable legs or abdominal feet and the head-capsule while

[1] During these stages they are what Trägardh designates as sap-feeders. Comp. Trägardh: Archiv. for Zoologi., Band 8, No. 9, 1913.

rounded inclines somewhat to the flattened wedge shape. The tentorial bridge and the ocelli are as in the flat instars, the latter however more strongly and evenly pigmented. The mandibles in shape approach those of the last stage.

The larva of the fourth instar does not differ essentially in structure from that of the last.

The mature larva (pl. 4, fig. 1) is in general body characters typical of the family. It is whitish, or, when it has fed up in the blotch mine, greenish, without color markings. The abdominal feet bear seven crochets in two curved rows all pointing backward (pl. 4, fig. 3). Tubercles and setæ of abdominal segment as figured (pl. 9, fig. 1); using Dyar's numbers, we would say that I is lower than II with I, III and V nearly in a straight line, IV absent or coalesced with V, VI absent; anal segment as figured (pl. 9, fig. 2). The head-capsule (pl. 5, figs 1, 2) is rounded, the dorsal side projecting over the ventral $\frac{1}{3}$; greatest width slightly lower than middle of head, well forward of tentorial bridge. Diameter of occipital foramen at dorsal extremity of hind margin $\frac{1}{2}$, at ventral extremity a trifle under $\frac{1}{2}$. Length of frons slightly over $\frac{1}{2}$; the frontal ridges converging in curved lines to a longitudinal ridge ($\frac{1}{8}$ long) connecting them with the hind margin, which projects $\frac{1}{4}$ into the head; adfrontal sclerites conspicuous but folded under frontal ridges. Tentorial bridge as in first instar; slightly less than $\frac{1}{3}$ in length; upper attachment of tentorial arms at middle of frontal ridges. Ocelli, five, in two longitudinal rows; 1, 2, 3, dorso-laterally placed; 1 and 2 grouped approximate to antennal ring; 3 back $\frac{1}{4}$; 4 and 5 grouped opposite of 3 on ventral side; all with well developed lenses; pigmented area broad and continuous under all the ocelli. Antenna (pl. 4, fig. 5) distinctly three-jointed; second joint with two papillæ and two hairs, the longer hair not extending beyond the extremity of the antenna; third joint as in *G. syringella*.[1] Post-labrum normal. Labrum (pl. 7, fig. 2) curving well down to the sides over the upper edge of the mandibles; median incision concaved and moderately deep; four pair of setæ, V and VI absent;[2] sides very thin, the lateral edges strengthened by a chitinous bar with six branches projecting inwardly for a short distance and giving a somewhat scalloped appearance to the margin. Epipharynx (pl. 7, fig. 1) densely tufted with hair-like filaments; the paired epipharyngeal plates tooth-like; epipharyngeal shield, heart-shaped, strongly chitinized and projecting beyond the median incision of the labrum. Mandible

[1] Comp. Trägardh: l. c., pp. 16–17.

[2] We have followed the system of numbering used by W. T. M. Forbes (Ann. Ent. Soc. Am., vol. III, No. 2, p. 96, 1910).

(pl. 4, fig 4) with five teeth, one ventrally compressed; when closed the toothed edge is vertical. Labium normal with short membrana articularia; in some specimens mentum and sub-mentum appear to be fused, in others the articulation is distinct. Cardo pear-shaped with small, irregular, strongly chitinized plate at the base. The triangular plates of the hypostoma meet approximately, their hind margins forming a rounded arch which projects for ¼ into the head-capsule. Maxillary palpus three-jointed with large palpiger; lacinia has three two-jointed digiti and two setæ; the base of the lacinia bears four or five overlapping plates connected by a chitinous band with similar plates on the maxillulæ[1] (pl. 6, fig. 1; pl. 7, fig. 3). Epicranial setæ eleven on the dorsal and seven on the ventral sides; there are also a varying number of punctures and small setitious tubercles on the basal half of the dorsal side. Length of full grown larva, 6–7 mm.

The last instar is a feeding one, the species differing in this regard from *Marmara* and the true *Gracilaria* which have a final specialized stage during which the larvæ are active and have functioning mandibles but do not use them for feeding.

The entire larval period is about twenty days.

COCOON.

After it leaves its mine the larva lets itself down by a strand of silk to a more secluded place where it spins a cocoon, nearly always on the under side of a leaf near the edge or against one of the ribs. The cocoon is a double affair consisting of a thin outer layer built up from the leaf, and a second, similar, inner layer, everywhere separated from the first by from 1 to 1.5 mm. The cocoon (pl. 1, fig. 4) is 14 mm. long, white, rather flattened, oval and transparent. The outer covering is decorated along the middle with from four to ten small, pearl-like globules similar to those on the *Marmara* cocoons, but fewer in number and less brilliant. This decorating of the cocoon is quite characteristic of several Gracilariidæ. Meyrick[2] mentions two Indian species (*A. austeropa*, Meyr., and *Epicephala chalybacma*, Meyr.) which have the same habit. These bubbles are also common to the cocoons of all the species of *Marmara*. Their purpose is considerable of a mystery but, as they have the appearance of eggs, they are presumably of some protective value to the pupa. At

[1] The presence of these organs in other Lepidopterous larvæ was pointed out by Busck and Böving in their recent paper on *Mnemonica auricyanea* (Proc. Ent. Soc. Wash., xvi, 4, pp. 153, 161, 1914).

[2] Jn. Bomb. Nat. Hist. Soc., p. 118, June 1914.

a former meeting of this society[1] Mr. Busck has given an account of the manner in which they are made. His observations were on *M. salictella* Clem., but, inasmuch as there is no reason for supposing the method to be different for the other Gracilariidæ having a similar habit, we may note his remarks here. In substance he says: after the outer covering of the cocoon is completed a slit is bitten through by the larva. A small globule secreted from the anus is then forced into the opening by the mandibles, fastened by a loop of silk and the slit sewn together. This process is repeated until the bubble content of the alimentary canal is exhausted.

PUPA.

Within its silken enclosure the pupa (pl. 9, fig. 3) is plainly visible. Throughout the pupal period it is noticably active, revolving rapidly on the axis of the body when disturbed; greenish brown and structurally normal according to Chapman's classification of the Gracilariidæ.[2]

Pupal period; six to ten days in summer.

ADULT.

The imago has steely-greyish-white palpi with two black rings on the terminal joint and two, and a faint third, on the second joint. Head and face whitish, streaked with black or blackish brown, the appressed scales falling well over the eyes and front. Thorax steel grey streaked with black, the dark portions more crowded towards the center. Forewings grey, suffused with brown giving the ground color a light, rather even, brownish tint; from the costal and dorsal margins several oblique white streaks interspersed with irregular patches and lines of black scales, these markings varying considerably in intensity and distinction of definition in different specimens but averaging as shown in the drawing (pl. 8, fig. 1); the apical area dark brown shading to black; apical cilia greyish white with a median band of black or blackish brown, white at the base, this white band forming with the costal and dorsal streaks of the apical portion a nearly complete white circle about the darkened area; costal cilia brownish; dorsal cilia brownish grey. Hind wings brownish grey; cilia concolorous, darkening toward apex. Abdomen brownish grey above, silvery beneath; the segments diagonally streaked along the sides with black, the streaks meeting obscurely on the dorsum. Legs whitish, striped with black. Anal tuft black, slightly marked with grey. Viewed from below the entire insect

[1] Proc. Wash. Ent. Soc., v, 102, 1902.

[2] The Entomologist, Lond., vol. xxxv, pp. 141-142, 1902.

has a striking black and white striped appearance. The venation is given in figures 2, 3 and 4 (pl. 8). A marked feature of this species is the costal fold in the hind wing of the male shown in figure 4 (pl. 8).

Alar expanse 8 mm.

In summer the entire life cycle of the insect from egg to imago, is completed in a trifle over a month.

It is very improbable that this species should ever prove of much economic importance. Though common, its feeding does not kill or seriously disfigure the infested leaves. As we have noted the larvæ only attack the newer leaves at the ends of branches and leaders. This specialized food habit coupled with the scarcity of their proper food supply during fall effectively prevents them from becoming overabundant for more than a short period during mid-summer. Parasites and predators also play their part. Four species of Hymenoptera,[1] parasitic on the larvæ have been reared, and on two occasions *Chrysopa* larvæ were found attacking the gracilariid in its mine, piercing the mid-rib with their mandibles and sucking the juices of the larva within. While wandering about after leaving their mines a number also fall victims of the spiders and birds; but these factors of natural control are of secondary importance as compared with the failure of large numbers of the fall larvæ to secure a proper food supply.

In conclusion the writers wish to thank their good friends August Busck and Drs. Adam Böving and Charles R. Ely for many helpful suggestions. Mr. Busck has also contributed the drawings of the wing venation (pl. 8, figs. 2, 3, 4) for this paper. All the other drawings are the work of J. J. DeGryse.

Explanation of Plates.

Plate I. Egg, work and cocoon.

Fig. 1, blotch mine made by larva after it leaves the mid-rib in search for more food.

Fig. 2, opening out by the larva on leaving mid-rib in order to pupate.

Fig. 3, egg (greatly enlarged).

Fig. 4, cocoon decorated with globules.

Fig. 5, normal mode of feeding in chestnut leaf; egg (*O*); point where larva emerges from mid-rib (*ep*).

Plate II. Larva in the first and second instars.

Fig. 1, mandible (ventral view).

[1] *Sympiesis flavipes* Ashmead, *Pseudopanteles nigripes* Roh., an *Arthrolytus* sp. and a single undeterminable male of the tribe Omphalini. (Det. by S. A. Rohwer.)

Fig. 2, Labrum (*lr*); Post-labrum (*pl*); Epipharynx (by transparency) (*ex*); Epipharyngeal shield (*es*).

Fig. 3, Labium (*li*); Hypopharynx (by transparency) (*hx*); Salivary duct (*sd*); Stipes labialis (*sl*); Digiti laciniæ (*dl*); Palipiger (*pgr*); Stipes maxillaris (*s*).

Fig. 4, mine made by larva in the first and second instars; dotted line indicates path of later stage larvæ through branching rib into the mid-rib.

Fig. 5, dorsal view of larva of the first and second instars; Antenna (*at*).

PLATE III. Head-capsule of larva in the first and second instars.

Fig. 1, ventral side of head: Epicranium (*epc*); Labium (*li*); Salivary ducts (*sd*); Stipes labialis (*sl*); Maxilla (*mx*); Stipes maxillaris (*s*); Cardo (*c*); Hypostoma (*h*); Tentorial bridge (*tb*); Mandible (*md*).

Fig. 2, dorsal side of head: Epicranium (*epc*); Frons (*f*); Frontal ridge fused with adfrontal sclerite (*adfr*); Tentorial arms (*ta*); Bridge formed by meeting of frontal ridges with hind margin (*ob*); Rudimentary ocellus (*ocl*); Labrum (*lr*); Post-labrum (*pl*); Mandible (*md*); Hypopharynx (*hx*); Antennal ring (*an*); Antenna (*at*).

PLATE IV. Mature larvæ.

Fig. 1, lateral view of mature larva.

Fig. 2, thoracic leg.

Fig. 3, abdominal leg: diagram showing arrangement of hooks.

Fig. 4, mandible (ventral view).

Fig. 5, antenna (segments indicated by Roman numerals).

(If Dampf's interpretation of the antennal joints is accepted, our joint II would become joint I and the seta bearing papilla at the top, joint III. —Comp. A. Dampf: Zoolog. Jahrb. Supp. 12, Heft. 3, p. 525, 1910).

PLATE V. Head capsule of mature larvæ.

Fig. 1, dorsal view of head: Epicranium (*epc*); Frons (*f*); Frontal ridge with adfrontal sclerite (*adfr*); Tentorial arms (*ta*); Ocelli (*ocl*); Antennal ring (*an*); Antenna (*at*); Labrum (*lr*); Mandible (*md*); Maxilla (*mx*); Spinneret (*sp*).

Fig. 2, ventral view of head: Epicranium (*epc*); Maxilla (*mx*); Hypostoma (*h*); Tentorial bridge (*tb*).

PLATE VI. Trophi of mature larva.

Fig. 1, lateral view of labium and hypopharynx: Labial palpi (*lp*); Spinneret (*sp*); Salivary duct (*sd*); Stipes maxillaris (*s*); Stipes labialis (*sl*); Point of attachment of lacinia (*atl*); Maxillulæ (*mxl*).

Fig. 2, labium and maxillæ (ventral view): Spinneret (*sp*); Labial palpus (*lp*); Stipes labialis (*sl*); Mentum (*m*); Submentum (*sm*); Cardo (*c*); Maxilla (*mx*); Stipes maxillaris (*s*); Membrana articularia (*mb*).

PLATE VII. Labrum, Epipharynx, and Hypopharynx of mature larva.

Fig. 1, Epipharynx (*ex*); Epipharyngeal shield (*es*); Internal and external epipharyngeal plates (*ep*); Epipharyngeal tufts (*et*); Sensory puncture (*spt*).

Fig. 2, labrum (*lr*); Postlabrum (*pl*); Epistoma (*e*).

Fig. 3, maxillæ, maxillulæ and hypopharynx: Basal (*mp* I), median (*mp* II) and apical (*mp* III) joints of maxillary palpus; Palpiger (*pgr*); Right lobe of maxillulæ in situ (*mxl*); Left lobe of maxillulæ dissected at base and extended (*mxl'*); Overlapping plates on outer edge of maxillulæ (*pp*) analogous plates (*pp'*) at base of lacinia (*l*); Hypopharynx (*hx*); Hypopharyngeal plate (*hp*).

PLATE VIII. Adult and wing-venation.

Fig. 1, adult.

Fig. 2, venation of forewing.

Fig. 3, venation of hindwing of female.

Fig. 4, venation of hindwing of male.

PLATE IX. Larvæ and pupa.

Fig. 1, abdominal segment of mature larva.

Fig. 2, anal segment of mature larva.

Fig. 3, pupa.

In the discussion of this paper Dr. Böving complimented the authors on their careful work and called attention to the rather scant literature dealing with the epipharyngeal and hypopharyngeal structures and especially to the work of the Danish author, H. F. Hansen, who first observed the so-called maxillulæ in insects and homologized them with corresponding structures in the Crustacea.

Dr. Böving expressed his particular satisfaction in having been able to call the attention of the authors to the very valuable paper by Dr. A. Dampf [Zur Kenntnis gehäusetragender Lepidopterenlarven (Zool. Jahrb. Suppl. Bd. 12, pp. 513-608, 54 figs. 1910.)] which deals with the same morphological problems as the present paper and as the recent paper by Busck and Böving [On Mnemonica auricyanea, Wlsm. (Proc. Ent. Soc. Wash. v. xvi, pp. 151-163, pl. ix-svi, 1915)].

He regretted very much, that he and Busck by an inexplicable slip of memory had overlooked the paper, of which Dr. Dampf had presented him a complimentary copy, when it appeared. It is a very important contribution and deserves careful consideration by all students of the morphology of Lepidoptera.

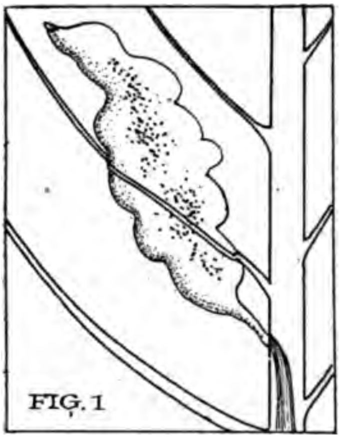


FIG. 1

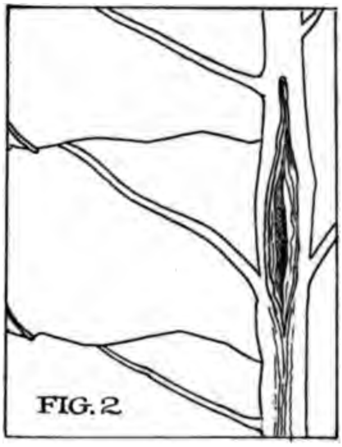


FIG. 2

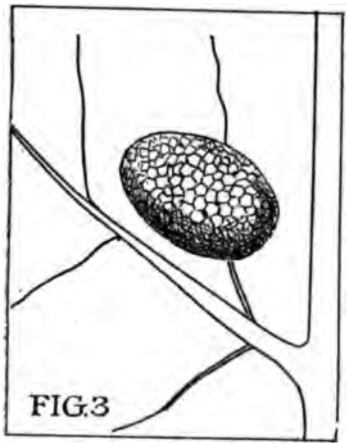


FIG. 3

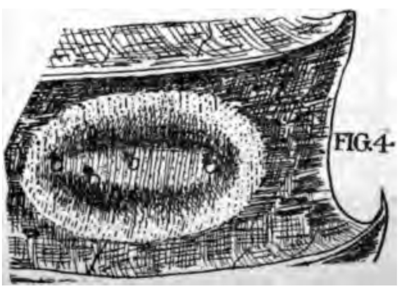


FIG. 4

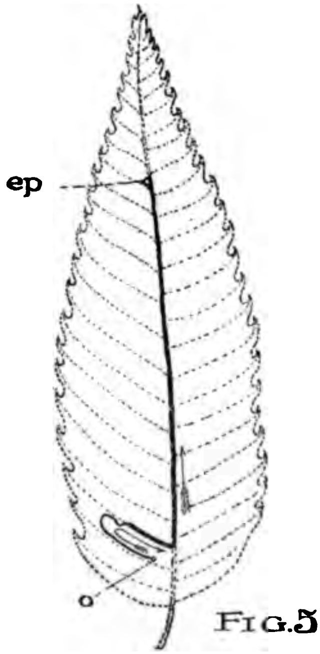


FIG. 5

FIG. 1

FIG. 2

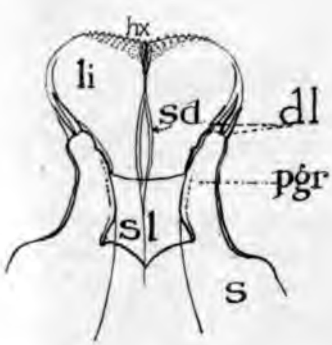
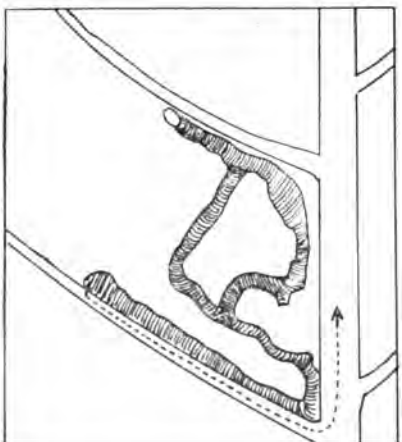
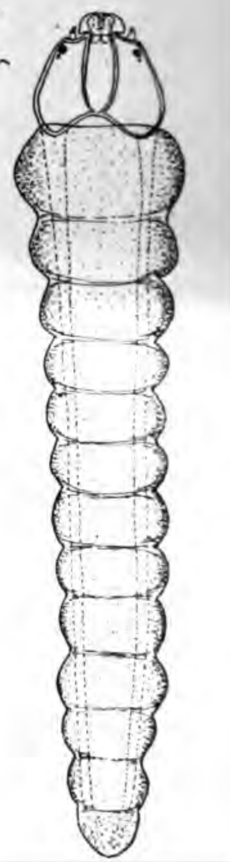


FIG. 3





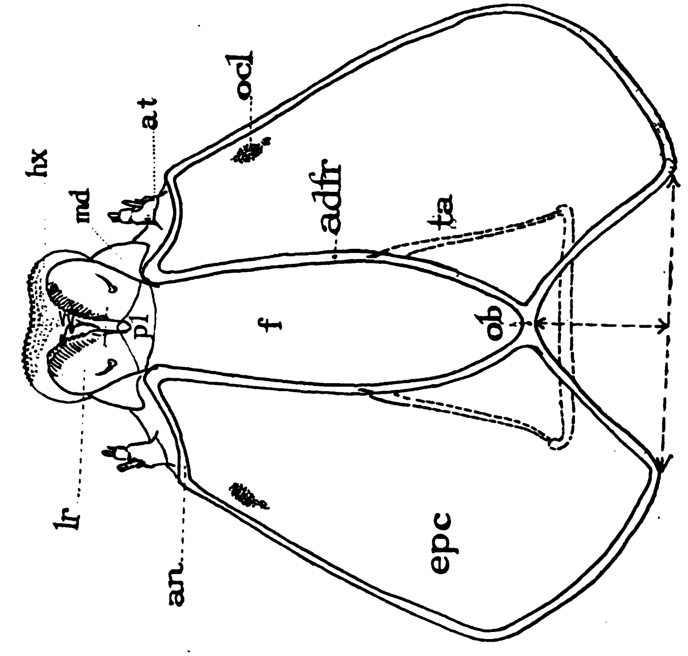


FIG. 2

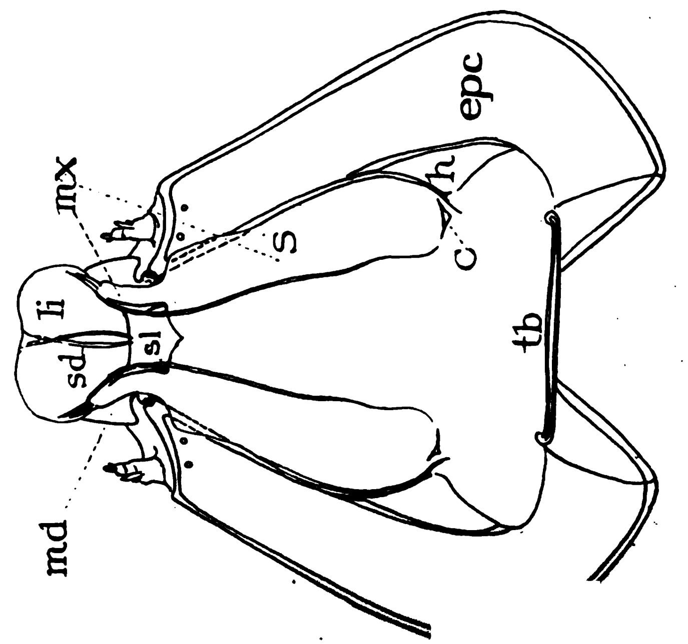


FIG. 1

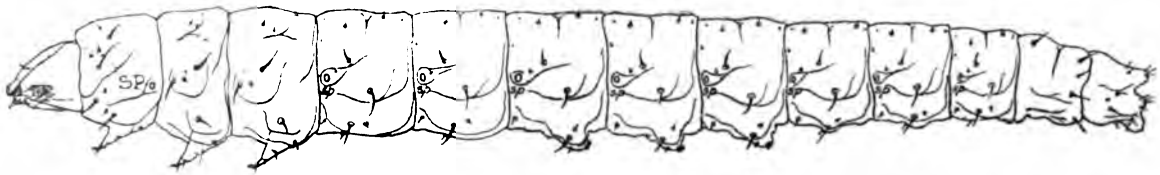


FIG. 1

FIG. 2

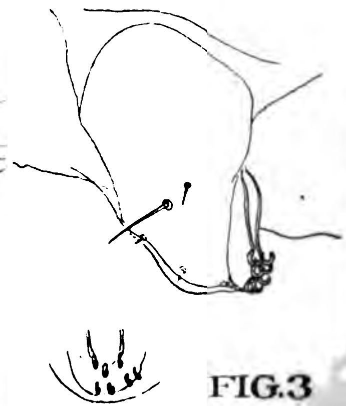


FIG. 3

FIG. 4

FIG. 5

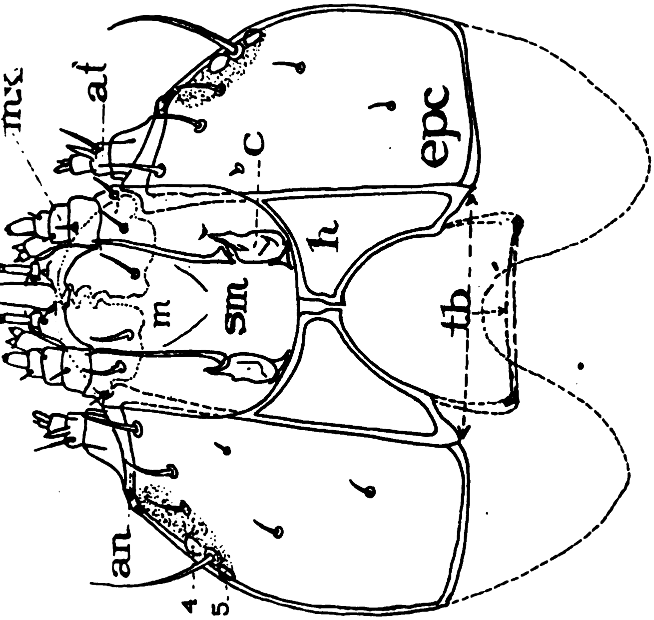


FIG. 2

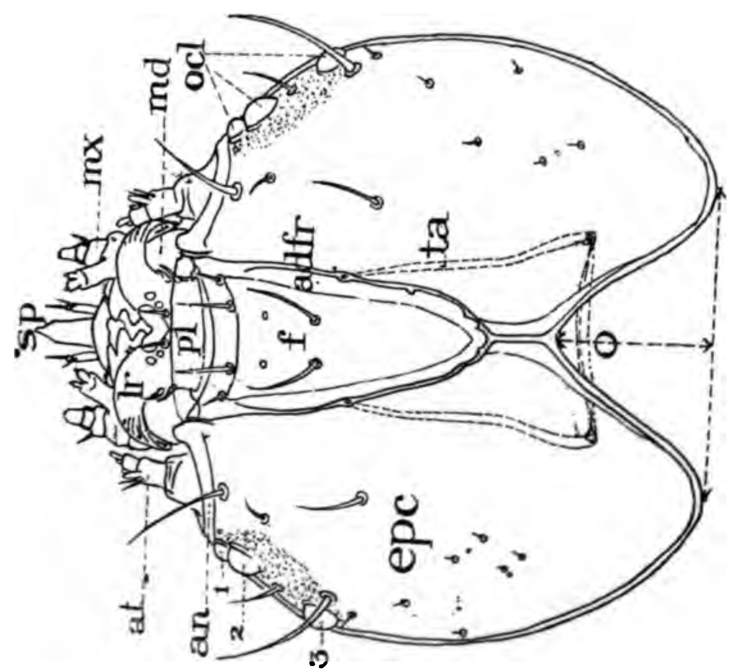


FIG. 1

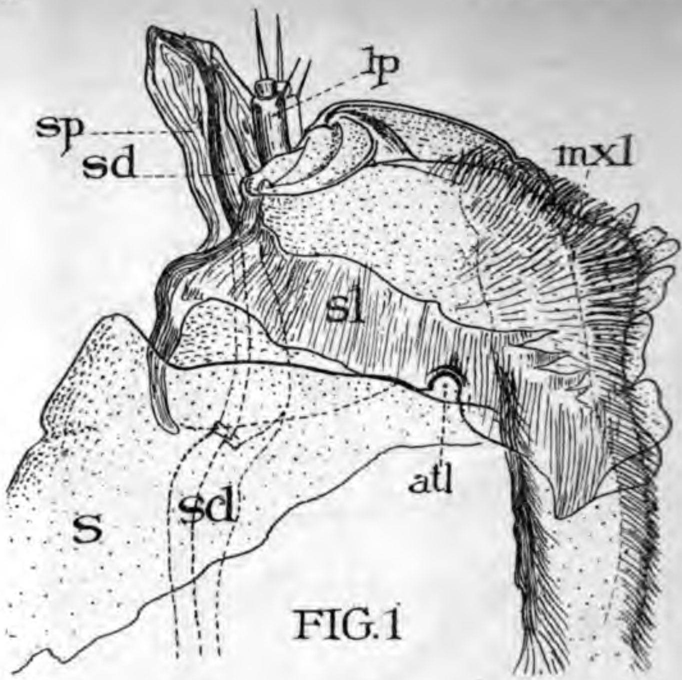
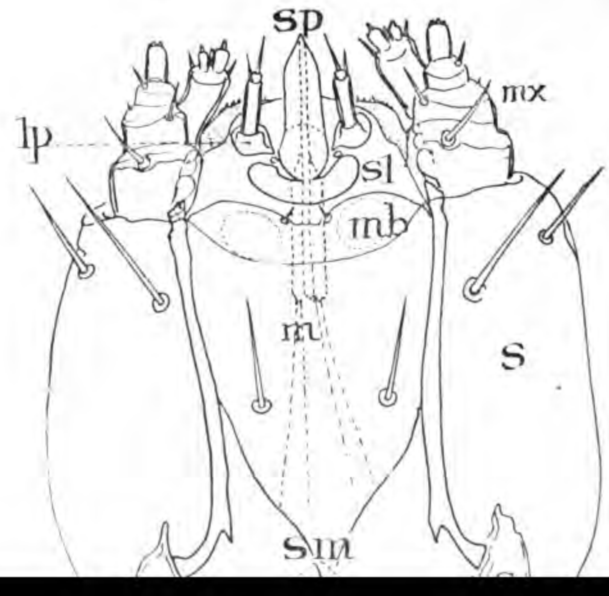


FIG. 1



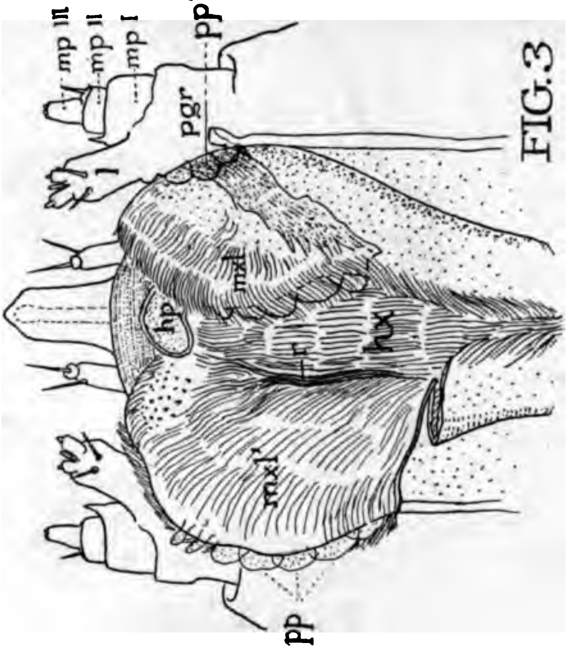


FIG. 3

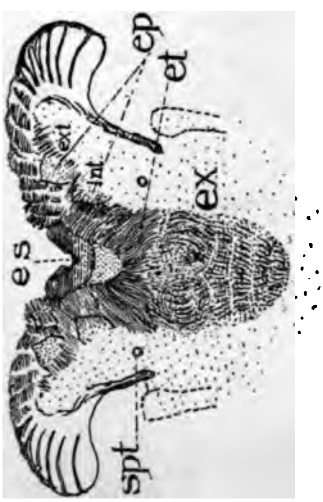


FIG. 1

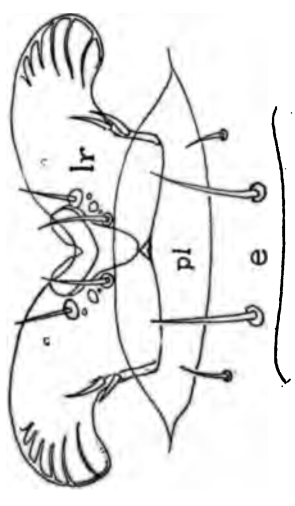


FIG. 2

FIG. 1

♂+♀

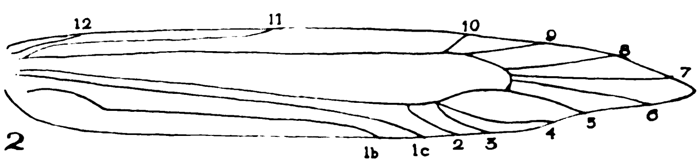


FIG. 2

♀

FIG. 3

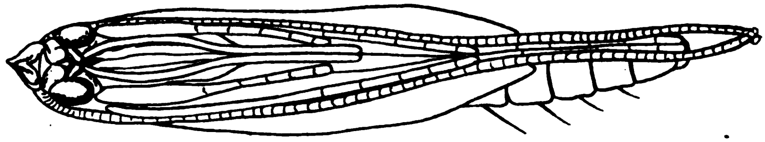


FIG. 3.

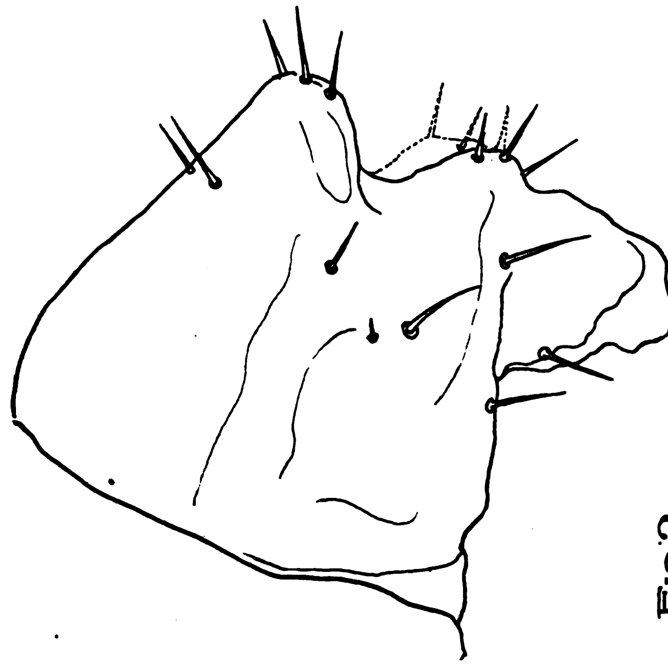


FIG. 2.

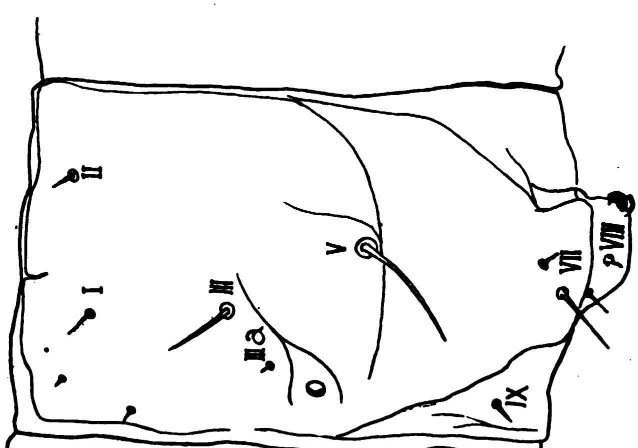


FIG. 1.

NOTES ON TWO PARASITIC DIPTERA.

By A. B. Gahan.

Credit for the following interesting rearings must go to Robert Fouts, a Washington school boy who was employed as helper in the laboratory at College Park, Md., the past summer. The parasitized hosts were in both cases collected and brought to the laboratory by him.

On September 3, 1914, an adult specimen of *Stagmomantis carolina* was picked up in Washington, D. C. When secured the mantid was alive but had a hole in the side of the abdomen through which could be seen a dipterous larva. Whether this wound was due to an old injury which had become maggot-infested or whether it was made by the dipterous larva preparatory to emergence is not known. The mantid was placed in a breeding jar with some earth and on the same date three full grown dipterous larvæ crawled out of the aperture and entered the soil. On September 21, three adult sarcophagids appeared in the jar. These have been determined by Mr. W. R. Walton as *Sarcophaga* (*Helicobia*) *helicis*.

In his Seventh Report on the Insects of Missouri, Riley records the rearing of a sarcophagid which he determined as *Sarcophaga carnaria* var. *mantivora* from a female *Mantis*. In referring to this record by Professor Riley, Coquillett in Insect Life, v, p. 23, states the host as *Stagmomantis carolina*, but omits the name of the parasite. These are the only records known to the writer of the rearing of sarcophagids from mantids. Mr. E. O. G. Kelly has recently shown *Sarcophaga helicis* to be parasitic on grasshoppers in Kansas (Jour. Agri. Research, U. S. Dept. Agri. vol. II, p. 441).

Two larvæ of *Leucania unipuncta* were taken at College Park, Md., July 27, 1914, and placed in a breeding jar. On July 29 there emerged from one of these larvæ a number of dipterous maggots. These pupated in the bottom of the jar and on August 6 two of the puparia produced adult tachinids. These flies were determined by Mr. Walton as *Metachaeta helymus*. This is believed to be the first record of a host for this species.

In discussing this paper Mr. Busck suggested the possibility that Mr. Gahan's sarcophagid fly-larvæ were not normally parasitic, but that they had gained entrance through the mouth of the mantid while the mantid was eating the mother fly; he told of one such case which he observed years ago. In 1897, he was

taking care of a brood of the large Chinese mantid *Paratenodera sinensis* Sauss., which had been bred from the eggs in the Insectary of the Bureau of Entomology. While the mantid larvæ were young and numerous they were kept together in one insect case and frequent cases of cannibalism occurred; but as they grew larger they were separated and kept each one in its own standard Riley insect case; they became quite tame and readily took living lepidopterous larvæ, flies, or even pieces of meat held by a pair of forceps. About one dozen reached maturity. One morning one of these was offered a large living sarcophagid fly held by the forceps; the mantid, eagerly grabbing it with its graspers, squeezed some living maggots out of the abdomen of the fly; several of these maggots were eaten by the mantid, two or three crawled out on its chin and were promptly wiped into the mouth. One morning sometime later this mantid was found lying on the sand in the case, alive but weak and as it was picked up three or four full grown fly maggots pushed out through the side of the abdomen; the maggots burrowed into the sand and eventually pupated, but the flies were not reared. Mr. Busck was convinced that these maggots were the ones eaten by the mantid and that they had passed the mouth parts of the greedy mantid unharmed and had been swallowed alive, and that they in this manner accidentally had become parasitic.

CATALOGUE OF RECENTLY DESCRIBED COCCIDÆ—V.[1]

By E. R. Sasscer, *Bureau of Entomology.*

Since the publication of the Catalogue of Recently Described Coccidæ—IV, October 19, 1912,[1] 4 new genera and 103 new species have been described. This makes a total of 33 new genera, 9 new subgenera, 643 new species, and 45 new varieties recorded since the appearance of Mrs. Fernald's catalogue in 1903. In preparing these catalogues the coöperation of coccidologists is earnestly solicited, especially in adding references which may have been overlooked.

[1] This catalogue is believed to be fairly complete to November, 1914, and is the continuation of a series of papers which have hitherto been published by the Bureau of Entomology, United States Department of Agriculture, as Technical Series, No. 12, Part I; Technical Series, No. 16, Part III; Technical Series, No 16, Part IV; Technical Series, No. 16, Part VI; and Technical Series, No. 16, Part VII.

Subfamily MONOPHLEBINÆ.

Aspidoproctus bouvieri Vayssiere.

Aspidiotus bouvieri Vayss., Bul. Soc. Ent. Fr., 10, p. 333 (1914).
Habitat—Gabun, French Equatorial Africa.
On ?

Aspidoproctus serrei Vayssiere.

Aspidoproctus serrei Vayss., Bul. Soc. Ent. Fr., 10, p. 334 (1914).
Habitat—Batavia (Java).
On?

Drosicha lichenoides Cockerell.

Drosicha lichenoides Ckll., Jn. Econ. Ent., VI, 1, p. 142 (1913).
Habitat—Philippine Islands.
On *Ficus nota*.

Lophococcus vuilleti Vayssiere.

Lophococcus vuilleti Vayss., Ann. Service Epiphyties, I, p. 424 (1913). Fig.
Habitat—Koulikoro (?), West Africa.
On *Acacia pennata*.

Icerya genistæ Hempel.

Icerya genistæ Hemp., Cat. Faun. Brazil, III, S. Paulo, pp. 18, 55 (1912).
Habitat—S. Paulo, Brazil.
On *Genista scoparia*, *Lespedeza striata*, strawberry (*Fragaria* sp.).

Icerya jacobsoni Green.

Icerya jacobsoni Green, Tijdschr. Ent., LV, p. 316 (1913). Fig.
Habitat—Java.
On *Dombeya acutangula*.

Icerya zeteki Cockerell.

Icerya zeteki Ckll., Jn. Econ. Ent., VII, 1, p. 148 (1914).
Habitat—Panama Canal Zone.
On ?

Llaveia luzonica Cockerell.

Llaveia luzonica Ckll., Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 334 (1914).
Habitat—Philippine Islands.
On ?

Monophlebus dugesi Vayssiere.

Monophlebus dugesi Vayss., Bul. Soc. Ent. Fr., 10, p. 335 (1914).
Habitat—Guanajuato (Mexico).
On ?

Palæococcus morrilli Cockerell.

Palæococcus morrilli Ckll., Ent. News, XXV, 3, p. 110 (1914).
Habitat—Arizona.
On ?

Subfamily **MARGARODINÆ.**

Kuwania britannica Green.[1]

Kuwania britannica Green, Ent. Mo. Mag., 2nd ser., xxv, p. 197 (1914). Fig.

Habitat—England.
On birch.

Margarodes indicus Green.

Margarodes indicus Green, Rec. Indian Mus., vii, pt. 1, No. 5, p. 69 (1912). Fig.

Habitat—India.
On ?

Margarodes niger Green.

Margarodes niger Green, Rec. Indian Mus., vii, pt. 1, No. 5, p. 75 (1912).

Habitat—Mysore.
In soil.

Margarodes papillosus Green.

Margarodes papillosus Green, Rec. Indian Mus., vii, pt. 1, No. 5, p. 74 (1912). Fig.

Habitat—Mysore.
In soil under rose.

Genus **NEOMARGARODES** Green. Type, **erythrocephala.**

Neomargarodes Green, Novitates Zoologicae, xxi, p. 263 (1914). Fig.

Neomargarodes erythrocephala Green.

Neomargarodes erythrocephala Green, Novitates Zoologicae, xxi, p. 263, (1914).

Habitat—Sahara Desert, Algeria.
On ?

Xylococcus napiformis Kuwana.

Xylococcus napiformis Kuwana, Jn. Ent. and Zool., Pomona, vi, 1, p. 1 (1914). Fig.

Habitat—Japan.
On *Quercus serrata.*

Subfamily **DACTYLOPINÆ.**

Eriococcus cockerelli Essig.

Eriococcus cockerelli Essig, Jn. Ent. and Zool., Pomona, v, 4, p. 179, (1913). Fig.

Habitat—Sonora, Mexico.
On "Chino."

---

[1] This appears to be a synonym of *Steingelia goodetskia* Nass.

Eriococcus festucæ Kuwana and Fukaya.

Eriococcus festucæ Kuw. and Fuk., Jn. Ent. and Zool., Pomona, VI, 1, p. 2 (1914). Fig.

Habitat—Japan.

On *Festuca parvigluma*.

Kermes branigani King.

Kermes branigani King, Jn. Ent. and Zool., Pomona, VI, 2, p. 100 (1914). Fig.

Habitat—California.

On maul oak (*Quercus chrysolepis*).

Kermes cordiformis Lindinger.

Kermes cordiformis Lindgr., Die Schildläuse, p. 286 (1912).

Habitat—Trieste, Austria.

On *Quercus robur*.

Kermes essigii King.

Kermes essigii King, Jn. Ent. and Zool., Pomona, V, 4, p. 205 (1913). Fig.

Habitat—California.

On *Quercus agrifolia*.

Kermes lindingeri King.

Kermes lindingeri King, Ent. Rundschau, XXXI, 6, p. 34 (1914).

Habitat—Germany.

On *Quercus sessiliflora*.

Kermes occidentalis King.

Kermes occidentalis King, Jn. Ent. and Zool., Pomona, V, 4, p. 206 (1913).

Habitat—California.

On *Quercus* sp.

Kermes sassceri King.

Kermes sassceri King, Jn. Ent. and Zool., Pomona, VI, 1, p. 48 (1914). Fig.

Habitat—Mass., Pa., N. Y., Calif., R. I., Canada.

On *Quercus rubra*.

Kermes waldeni King.

Kermes waldeni King, Jn. Econ. Ent., VII, 1, p. 150 (1914).

Habitat—Connecticut.

On *Quercus* sp.

Lachnodius greeni Vayssiere.

Lachnodius greeni Vayss., Bul. Soc. Ent. Fr., 5, p. 156 (1914).
Vayss., Bul. Soc. Ent. Fr., 7, p. 208 (1914).

Habitat—Madagascar.

On Coffee roots and trunks (in ground).

Phenacoccus azaleæ Kuwana.

Phenacoccus azaleæ Kuw., Jn. Ent. and Zool., Pomona, VI, 1, p. 1 (1914). Fig.

Habitat—Japan.

On Azalea.

Trionymus violascens Cockerell.

Trionymus violascens Ckll., Jn. Econ. Ent., VI, 1. p. 143 (1913).

Habitat—Colorado.

On *Agropyron*.

Phenacoccus betheli Cockerell.

Phenacoccus betheli Ckll., Can Ent., XLIV, 10, p. 301 (1912).
Can. Ent., XLV, 1, p. 14 (1913).

Habitat—Arizona, Colorado.

On *Amelanchier*.

Pseudococcus calluneti Lindinger.

Pseudococcus calluneti Lindgr., Die Schildläuse, p. 90 (1912).

Habitat—Denmark.

On *Calluna*.

Pseudococcus capensis Brain.

Pseudococcus capensis Brain, Ann. Ent. Soc. Am., v, 2, p. 182 (1912). Fig.

Habitat—South Africa.

On *Phytolacca dioica*, *Albizzia lophantha*, *Solanum sodomæum*, *Clematis vitalba*, *Pelargonium* sp., *Sonchus oleraceus*, *Senecio vulgaris*, *Malva parviflora*, *Oxalis cernua*, stored pumpkins and vines.

Pseudococcus fragilis Brain.

Pseudococcus fragilis Brain, Ann. Ent. Soc. America, v, 2, p. 186 (1912).

Habitat—South Africa.

On Orange.

Pseudococcus lounsburyi Brain.

Pseudococcus lounsburyi Brain, Ann. Ent. Soc. America, v, 2, p. 179 (1912). Fig.

Habitat—South Africa.

On *Agapanthus umbellatus*.

Pseudococcus marchali Vayssiere.

Pseudococcus marchali Vayss., Bul. Soc. Ent. Fr., 17, p. 366 (1912). Fig.
Vayss., Ann. Service Epiphyties, I, p. 428 (1913).

Habitat—Upper Guinea, Africa.

On mango.

Pseudococcus muraltiæ Brain.

Pseudococcus muraltiæ Brain, Ann. Ent. Soc. America, v, 2, p. 184 (1912). Fig.

Habitat—South Africa.

On *Muraltia heisteria*.

Pseudococcus nicotianæ Leonardi.

Pseudococcus nicotianæ Leon., Boll. Tec. d. Colt. d. Talac. (Scafati), XII, 2, p. 76 (1913).
Habitat—Prov. Salerno, Italy.
On *Nicotiana colossea*, *N. macrophylla*.

Pseudococcus phoradendri Cockerell.

Pseudococcus phoradendri Ckll., Jn. N. Y. Ent. Soc., XX, 2, p. 133 (1912).
Habitat—Arizona.
In hollow stems of *Phoradendron flavescens*, var. *villosum*, attended by *Cremastogaster arizonensis* Wheeler.

Pseudococcus wachendorfiæ Brain.

Pseudococcus wachendorfiæ Brain, Ann. Ent. Soc. America, v, 2, p. 183 (1912). Fig.
Habitat—South Africa.
On *Wachendorfia paniculata*.

Pseudococcus yerba-santæ Essig.

Pseudococcus yerba-santæ Essig, Jn. Ent. and Zool., v, 2, p. 85 (1913). Fig.
Habitat—California.
On Yerba Santa or Mountain Balm (*Eriodictyon californicum*).

Ripersia taquaræ Hempel.

Ripersia taquaræ Hemp., Cat. Faun. Brazil, III, S. Paulo, pp. 25, 58 (1912).
Habitat—S. Paulo, Brazil.
On interior of large cane accompanied by ants.

Subfamily **TACHARDINÆ**.

Tachardia angulata Froggatt.

Tachardia angulata Frogatt, Pr. Linn. Soc. N. S. Wales, XXXVI, 1, p. 154 (1911).
Habitat—N. S. Wales.
On quince trees.

Genus **COLOBOPYGA** Brèthes. Type, **magnani.**

Colobopyga Brèthes, An. Mus. Nac. Buenos Aires, XXIII, p. 279 (1912).

Colobopyga magnani Brèthes.

Colobopyga magnani Brèthes, An. Mus. Nac. Buenos Aires, XXIII, p. 281 (1912).
Habitat—Buenos Aires.
On *Chamærops humilis*.

Subfamily **COCCINÆ.**

Aclerda signoreti Lindinger.

Aclerda signoreti Lindgr., Die Schildläuse, p. 170 (1912).
Habitat—France, Austria.
On grass.

Ceronema africana Scott Macfie.

Ceronema africana Scott Macfie, Bul. Ent. Res., IV, 1, p. 31 (1913). **Fig.**
Vayss., Bul. Soc. Ent. Fr., 7, p. 208 (1914).
Habitat—Northern Nigeria.
On "Pride of Barbadoes" (*Cæsalpinia pulcherrima*).

Ceroplastes coniformis Newstead.

Ceroplastes coniformis Newst., Bul. Ent. Res., IV, 1, p. 72 (1913). Fig.
Gowdey, Bul. Ent. Res., IV, 3, p. 248 (1913).
Habitat—Uganda.
On *Ficus* sp.

Ceroplastes excœcariæ Hempel.

Ceroplastes excœcariæ Hemp., Cat. Faun. Brazil, III, S. Paulo, pp. 33, 66 (1912). Fig.
Habitat—S. Paulo, Brazil.
On *Excœcaria biglandulosa.*

Ceroplastes gigas Cockerell.

Ceroplastes gigas Ckll., Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 331 (1914). Fig.
Habitat—Philippine Islands.
On ?

Coccus citricola Campbell.

Coccus citricola Campb., Ent. News, XXV, 5, p. 222 (1914).
Habitat—California.
On Citrus.

Lecanium filamentosum Newstead.

Eulecanium filamentosum Newst., Bul. Ent. Res., IV, 1, p. 74 (1913). Fig.
Gowdey, Bul. Ent. Res., IV, 3, p. 248 (1913).
Habitat—Uganda.
On unknown forest shrub.

Lecanium opimum Green.

Lecanium opimum Green, Tijdschr. Ent., LV, p. 313 (1913). Fig.
Habitat—Java.
On *Cassia fistula.*

Lecanium perinflatum Cockerell.

Lecanium perinflatum Ckll., Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 332 (1914). Fig.

Habitat—Argentine Republic.

On herbaceous plant.

Lecanium pseudomagnoliarum Kuwana.

Eulecanium pseudomagnoliarum Kuw., Jn. Ent. and Zool., Pomona, VI, 1, p. 7 (1914). Fig.

Habitat—Japan.

On *citrus*.

Mesolecanium lucidum Hempel.

Mesolecanium lucidum Hemp., Cat. Faun, Brazil, III, S. Paulo, pp. 38, 67 (1912).

Habitat—State of Rio Grande do Sul, Brazil.

On Solanaceæ.

Paralecanium luzonicum Cockerell.

Paralecanium luzonicum Ckll., Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 333 (1914).

Habitat—Philippine Islands.

On *Plectronia viridis*.[1]

Protopulvinaria longivalvata bakeri Cockerell.

Protopulvinaria longivalvata bakeri Ckll., Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 333 (1914). Fig.

Habitat—Philippine Islands.

On leaves of *Voacanga globosa*.[2]

Pseudokermes cooleyi King.

Pseudokermes cooleyi King, Jn. Econ. Ent., VII, 2, p. 246 (1914).

Habitat—Montana.

On *Picea englemanni*.

Pulvinaria citricola Kuwana.

Pulvinaria citricola Kuw., Jn. Ent. and Zool., Pomona, VI, 1, p. 3 (1914). Fig.

Habitat—Japan.

On Citrus, *Diaspyros kaki*, *Hibiscus syriacus*.

Pulvinaria idesiæ Kuwana.

Pulvinaria idesiæ Kuw., Jn. Ent. and Zool., Pomona, VI, 1, p. 6 (1914). Fig.

Habitat—Japan.

On *Idesia polycarpa*, *Phellodendron amurensis*.

[1] Incorrectly cited as *Alectronia*.

[2] Incorrectly cited as "becanga."

Pulvinaria okitsuensis Kuwana.

Pulvinaria okitsuensis Kuw., Jn. Ent., and Zool., Pomona, VI, 1, p. 5 (1914). Fig.
Habitat—Japan.
On Orange.

Pulvinaria ornata Hempel.

Pulvinaria ornata Hemp., Cat. Faun. Brazil, III, S. Paulo, pp. 28, 61 (1912).
Habitat—S. Paulo, Brazil.
On *Arrabidæa.* (Bignoniaceæ)

Pulvinaria photiniæ Kuwana.

Pulvinaria photiniæ Kuw., Jn. Ent. and Zool., Pomona, VI, 1, p. 4 (1914). Fig.
Habitat—Japan.
On *Photinia villosa, Celtis sinensis.*

Megasaissetia brasiliensis Hempel.

Megasaissetia brasiliensis Hemp., Cat. Faun. Brazil., III, S. Paulo, pp. 42, 68 (1912).
Habitat—S. Paulo, Brazil.
On ?

Saissetia lucida Hempel.

Saissetia lucida Hemp., Cat. Faun. Brasil, III, S. Paulo, pp. 41, 60 (1912).
Habitat—S. Paulo, Brazil.
On bark of forest tree.

Stictococcus gowdeyi Newstead.

Stictococcus gowdeyi Newst., Bul. Ent. Res., IV, 1, p. 70 (1913). Fig.
Gowdey, Bul. Ent. Res., IV, 3, p. 249 (1913).
Gowdey, Ann. Rept. Dept. Agr., Uganda Protec., p. 29 (1913).
Habitat—Uganda.
On *Haronga madagascariensis;* Coffee.

Subfamily **DIASPINÆ.**

Aspidiotus alatus Froggatt.

Aspidiotus alatus Froggatt, Agr. Gaz. N. S. W., XXV, 2, p. 132 (1914). Fig.
Habitat—New South Wales, Victoria.
On *Eucalyptus rostrata, Eucalyptus* sp.

Aspidiotus confusus Froggatt.

Aspidiotus confusus Frogg., Agr. Gaz., N. S. W., XXV, 2, p. 136 (1914). Fig.
Habitat—New South Wales.
On white gum (*Eucalyptus* sp.).

Aspidiotus ephedrarum Lindinger.

Aspidiotus ephedrarum Lindgr., Die Schildläuse, p. 139 (1912).
Habitat—Sardinia, South East Spain.
On *Ephedra nebrodensis, E. scoparia.*

Aspidiotus gidgei Froggatt.

Aspidiotus gidgei Frogg., Agr. Gaz. N. S. W., xxv, 4, p. 313 (1914).
Habitat—New South Wales.
On Gidgei (*Acacia cambagei*).

Aspidiotus gowdeyi Newstead.

Aspidiotus gowdeyi Newst., Bul. Ent. Res., IV, 1, p. 77 (1913). Fig. Gowdey, Bul. Ent. Res., IV. 3, p. 249 (1913).
Habitat—Uganda.
On *Anona muricata.*

Aspidiotus junctilobius Froggatt.

Aspidiotus junctilobius Frogg., Agr. Gaz. N. S. W., xxv, 4, p. 315 (1914) Fig.
Habitat—Southwestern New South Wales.
On yarran (*Exocarpus aphylla*).

Aspidiotus lenticularis Lindinger.

Aspidiotus lenticularis Lindgr., Die Schildläuse, pp. 149, 230 (1912).
Habitat—Denmark.
On ?

Aspidiotus rubribullatus Froggatt.

Aspidiotus (Aspidiella) rubribullata Frogg., Agr. Gaz. N. S. W., xxv, 4, p. 317 (1914). Fig.
Habitat—West Australia, New South Wales.
On *Eucalyptus.*

Aspidiotus serratus Froggatt.

Aspidiotus serrata Frogg., Agr. Gaz. N. S. W., xxv, 4, p. 318 (1914).
Habitat—New South Wales.
On leaves of Gidgei or Mulga (*Acacia cambagei*).

Aspidiotus tafiranus Lindinger.

Aspidiotus tafiranus Lindgr., Die Schildläuse, p. 229 (1912).
Habitat—Canary Islands.
On *Olea* sp.

Gymnaspis acaciæ Froggatt.

Gymnaspis acaciæ Frogg., Agr. Gaz. N. S. W., xxv, 7, p. 604 (1914). Fig.
Habitat—New South Wales.
On "Weeping Myall" (*Acacia pendula*).

Gymnaspis africana Newstead.

Gymnaspis africana Newst., Bul. Ent. Res., IV, 1, p. 78 (1913). Fig.
Gowdey, Bul. Ent. Res., IV, 3, p. 249 (1913).
Habitat—Uganda.
On unknown forest shrub.

Hemiberlesia nitrariæ Marchal.

Aspidiotus (Hemiberlesia) nitrariæ Marchal, Bul. Soc. Zool. France, XXXVI, 45 and 6, p. 150 (1911).
Habitat—South Tunis.
On *Nitraria*.

Hemiberlesia provincialis Vayssiere.

Aspidiotus (Hemiberlesia) provincialis Vayss., Bul. Soc. Ent. Fr., 7, p. 207 (1914).
Habitat—Bouches du Rhone, France.
On Grass (*Ammophila arenaria* (?)).

Odonaspis schizostachyi Cockerell and Robinson.

Odonaspis schizostachyi Ckll. and Robinson, Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 327 (1914). Fig.
Habitat—Philippine Islands.
On climbing bamboo (*Schizostachyum* sp.)

Targionia carolina Froggatt.

Aspidiotus (Targionia) carolinus Frogg., Agr. Gaz. N. S. W., XXV, 2, p. 136 (1914). Fig.
Habitat—New South Wales.
On *Eremophila sturtii* (Myoporineæ).

Targionia laurina Lindinger.

Targionia laurina Lindgr., Die Schildläuse, p. 198 (1912).
Habitat—Madeira.
On *Laurus canariensis*.

Pseudotargionia Lindinger n. subg. of *Targionia*. Type, *glandulosa* Newst.

Lindinger, Die Schildläuse, p. 50 (1912).

Aulacaspis manzanitæ Whitney.

Aulacaspis manzanitæ Whitney, Jn. Ent. and Zool., v, 1, p. 50 (1913). Fig.
Habitat—California.
On *Arctostaphylos, Manzanita* sp.

Epidiaspis subterranea Lindinger.

Epidiaspis subterranea Lindgr., Die Schildläuse, p. 174 (1912).
Habitat—France.
On Grass.

Diaspis senegalensis Vayssiere.

Diaspis senegalensis Vayss., Bul. Soc. Ent. Fr., 7, p. 206 (1914). Fig.
Habitat—Senegal.
On leaves of *Khaya senegalensis*.

Diaspis syriaca Lindinger.

Diaspis syriaca Lindgr., Die Schildläuse, p. 264 (1912).
Habitat—Syria.
On *Pistacia vera*.

Diaspis taxicola Vayssiere.

Diaspis taxicola Vayss., Rev. Phytopath. Appliquée, Paris, I, 9, p. 124 (1913).
Habitat—Algeria.
On *Taxus baccata*.

Phenacaspis mischocarpi Cockerell and Robinson.

Phenacaspis mischocarpi Ckll. and Robinson, Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 328 (1914). Fig.
Habitat—Philippine Islands.
On *Mischocarpus fuscescens*.

Phenacaspis unilateralis Newstead.

Chionaspis unilateralis Newst., Bul. Ent. Res., IV, 1, p. 79 (1913). Fig.
Habitat—Barbados.
On leaves of palm (*Thrimax ?*).

Protodiaspis agrifoliæ Essig.

Protodiaspis agrifoliæ Essig, Jn. Ent. and Zool., VI, 2, p. 76 (1914). Fig.
Habitat—California.
On *Quercus agrifolia*.

Chionaspis austriaca Lindinger.

Chionaspis austriaca Lindgr., Die Schildläuse, p. 252 (1912).
Habitat—Austria (Piesting?).
On *Pinus laricio nigricans*.

Chionaspis nigerensis Vayssiere.

Chionaspis nigerensis Vayss., Bul. Soc. Ent. Fr., 17, p. 368 (1912). Fig.
Vayss., Ann. Service Epiphyties, I, p. 428 (1913).
Habitat—Upper Senegal—Niger, Africa.
On *Xymenia americana*.

Hemichionaspis uvariæ Cockerell and Robinson.

Hemichionaspis uvariæ Ckll. and Robinson, Bul. Am. Mus. N. H., XXXIII, Art. XXV, p. 330 (1914). Fig.
Habitat—Philippine Islands.
On leaves of *Uvaria* sp.

Lepidosaphes chitinosa Froggatt.

Mytilaspis chitinosa Frogg., Agr. Gaz. N. S. W., xxv, 7, p. 607 (1914). Fig.

Habitat—New South Wales.

On Native Broom (*Templetonia egena*).

Lepidosaphes cortrioides Froggatt.

Mytilaspis cortrioides Frogg., Agr. Gaz. N. S. W., xxv, 7, p. 609 (1914).

Habitat—New South Wales.

On Black Wattle (*Acacia decurrens*).

Lepidosaphes crassa Froggatt.

Mytilaspis crassa Frog., Agr. Gaz. N. S. W., xxv, 7, p. 609 (1914).

Habitat—New South Wales.

On Ti-tree (*Melaleuca* sp.).

Lepidosaphes dispar Vayssiere.

Mytilaspis (*Coccomytilus*) *dispar* Vayss., Rev. Phytopath. Appliqueé, Paris, I, 9, p. 124 (1913).

Vayss., Bul. Soc. Ent. Fr., 7, p. 208 (1914).

Habitat—Madagascar.

On Manihot.

Lepidosaphes eucalypti Froggatt.

Mytilaspis eucalypti Frogg., Agr. Gaz. N. S. W., xxv, 7, p. 610 (1914) Fig.

Habitat—New South Wales.

On *Eucalyptus piperita*.

Lepidosaphes juniperi Lindinger.

Lepidosaphes juniperi Lindgr., Die Schildläuse, p. 188 (1912).

Habitat—Turkey in Asia.

On *Juniperus excelsa*.

Lepidosaphes lobulatus Froggatt.

Mytilaspis lobulatus Frogg., Agr. Gaz. N. S. W., xxv, 8, p. 680 (1914). Fig.

Habitat—New South Wales.

On *Casuarina* sp.

Lepidosaphes mulgæ Froggatt.

Mytilaspis mulgæ Frogg., Agr. Gaz. N. S. W., xxv, 8, p. 681 (1914).

Habitat—New South Wales.

On Mulga or Gidgei (*Acacia cambagei*).

Lepidosaphes recurvata Froggatt.

Mytilaspis recurvata Frogg., Agr. Gaz. N. S. W., xxv, 8, p. 683 (1914). Fig.

Habitat—New South Wales.

On Black Wattle (*Acacia decurrens*).

Genus **PARLATOREOPSIS** Lindinger. Type, **longispina** Newst.
Lindinger, Die Schildläusse, p. 191 (1912).

Pseudoparlatoria argentata Hempel.

Pseudoparlatoria argentata Hemp., Cat. Faun. Brazil, III, S. Paulo, pp. 51, 63 (1912).

Habitat—S. Paulo, Brazil.

On *Aglaia* sp.

DIPTEROLOGICAL MISCELLANY.

By Frederick Knab, *Bureau of Entomology*.

EVOLUTION OF THE BLOOD-SUCKING HABIT IN SYMPHOROMYIA.

In several families of Diptera the blood-sucking habit is unequally developed in different species. Thus, in the Culicidæ we have within the same genus species that are aggressive bloodsuckers, others that apparently have but a weak craving for blood, and still others that do not bite at all. Similar conditions appear to obtain in the chironomid subfamily Ceratopogoninæ, while in the family Psychodidæ the blood-sucking habit is restricted to the genus *Phlebotomus*.

The leptid genus *Symphoromyia* has been reported as a bloodsucker several times, but, as its chief habitat is in the comparatively unsettled Rocky Mountain region, we have very little exact information on the habits of the different species. Prof. J. M. Aldrich, who has recently revised the genus, informs me that two species appear to be the principal biters and that he has only a single record for a third species. These data will appear in a paper which Prof. Aldrich now has in press. Some additional information has recently come to hand and the indications are that certain species of *Symphoromyia* are aggressive biters, while others are in process of acquiring the blood-sucking habit. Of course, it is possible that some of the inoffensive species feed upon animals other than man and the large mammals. A specimen and note recently sent in by W. H. Boyd of Cottonwood, British Columbia, adds a fourth species, *Symphoromyia pachyceras* Will., to the list of blood-suckers. The interesting part of the note is that it appears to show that this species is in a transition state. Mr. Boyd says that this species "bites for itself on unprotected portions of animals, but seems to prefer to take the blood oozing from a bite left by the larger fly" (*Tabanus*).

It must, however, be remembered that the species of *Symphoromyia* are all similar in appearance and that the individuals lapping the blood from wounds may belong to different species

from those that actually bite. The case reminds one forcibly of the condition found by Captains Patton and Cragg among certain forms of Muscidæ in India.[1] It may be added that a specimen of *Symphoromyia pachyceras* (det. Aldrich) in the National collection, taken by H. S. Barber at Williams, Arizona, bears the label "biting." Recently the same species has been reported as biting by Dr. J. C. Bradley.[2] The specimens identified by the writer as *pachyceras* in a previous paper,[3] have been placed by Prof. Aldrich in the course of his revisional work under *S. hirta* Johnson.

MUSCA LEPRÆ LINNÉ.

Under the name *Musca lepræ* the following appears on page 598 of the tenth edition of the Systema Naturæ:

M. antennis setariis atra nitens, antennis pedibusque albis, oculis rufo inauratis.

Habitat in *Elephantiasi* Nigritum Americæ. Rolander. Corpus pediculo minus. Abdomen subtus & basi album. Denticulus utrinque ad basin proboscidis.

The description is quite unrecognizable. Later Wiedemann described a small fly under the name *Chlorops lepræ*, but expressed doubt as to its identity with the species described by Linnæus.[4] Becker has recently identified the specimen on which Wiedemann based his description as a species of *Hippelates*.[5] He also questions its identity with the Linnean species, but retains the specific name on the ground that it has been removed to a different genus.

For medical entomology the identity of the Linnean species is a question of considerable interest. No taxonomic data appear in the original description that could serve for accurate identification, but the identity of the fly might be established with the aid of the other data by one favorably situated. Linnæus evidently intended to indicate that the larvæ of the fly occurred in cases of elephantiasis and is so interpreted by Wiedemann.

---

[1] Patton, W. S., and F. W. Cragg. On certain hæmatophagous species of the genus Musca, with descriptions of two new species. Indian Journ. Med. Research, vol. 1, no. 1, p. 11–25; 1913.

[2] Riley, Wm. A., and O. A. Johannsen. Handbook of Medical Entomology, 1915, p. 112.

[3] Knab, Frederick, and R. A. Cooley. Symphoromyia as a blood-sucker. Proc. Ent. Soc. Wash., vol. 14, p. 161–162; 1912.

[4] Aussereurop. zweifl. Ins., vol. 2, p. 598 (1830).

[5] Ann. Mus. Nat. Hung., vol. 10, p. 172 (1912).

Presumably the larvæ occur in lesions in advanced cases of elephantiasis and the fly is to be sought for among the scavenger forms. The body of the fly is said to be less than that of a louse. Among such small forms of scavenger habits the group that naturally suggests itself is the Phoridæ. They are common in the tropics and infest all sorts of organic substances, from dead insects and molluscs to human fæces, one species being known even to invade the human cloaca.[1] In a suitable locality, such as some of the West Indian islands where elephantiasis is common, it would be easy, no doubt, to rediscover the fly.

A CASE OF PHORESY.

A few years ago Mr. Nathan Banks gave a review of the literature treating of insects being transported by other species.[2] Many of the observed cases have been Borboridæ transported by dung beetles, the flies evidently employing this method to reach suitable breeding places. The habit appears to be a fixed one in certain species and one species, *Limosina sacra*, has received its specific name on account of its association with the sacred beetle, *Ateuchus sacer*. While the habit has been observed repeatedly in the warmer parts of the Old World, there is but one record for America and in that case the flies were not identified.[3] Mr. W. D. Pierce has handed me several specimens of Borboridæ which he captured recently (October 15, 1914) at Madison, Florida, while they were riding on the dung beetle, *Canthon viridis*. He tells me there were over twenty of the flies on and hovering about the beetle. The flies proved to belong to two very distinct species, a small one with milk-white wings and a larger one with smoky wings. The former proved to belong to the genus *Borborus* and is probably an undescribed species; probably it is the same one observed by Moulton in Missouri, for he particularly mentions the white wings of the flies The specimens of the second species taken by Mr. Pierce were unfortunately destroyed by an accident, but probably were also a species of the genus *Borborus*.

Under the heading of Notes and Exhibition of Specimens, the following was presented by the author who also exhibited specimens and drawings of the flies under consideration:

[1] Austen, Trans. Soc. Trop. Med. and Hyg., vol. 3, p. 229–232 (1910). Laurence, Brit. Med. Journ., vol. 2 for 1910, p. 376.

[2] Cases of phoresie. Entom. News, vol. 22, pp. 194-197 (1911).

[3] Moulton, J. T., Flies riding on tumble-dung. Amer. Ent., vol. 3, p. 226 (1880).

NOTE ON THE SPALLANZANIINE FLIES.

(AUTHOR'S ABSTRACT.)

BY C. H. T. TOWNSEND, *Bureau of Entomology.*

The two species *Pseudogonia ruficauda* Townsend (1892) and *Cnephalomyia floridana* Townsend (1912) are so similar in the adult as to be indistinguishable until one has learned the very slight but constant differences that separate them. Their eggs and first-stage maggots are greatly contrasted, though both belong to the microtype-egg stocks. They represent distinct genera, and the former will become the type of a new genus. They are evidently cases of convergent evolution in the adult, in conjunction with divergent evolution in the early stages, indicated not only by the egg and first-stage maggot characters but also by the character of the slight external differences of the fly, and have traveled separate paths of development from distinct origins within the *Spallanzania* group, though no doubt of ancient common origin. On external characters alone, one would unhesitatingly refer both to the same genus, and a nice discrimination is required to satisfy oneself that they are not the same species. This is a notable case of the early-stage characters constituting an index to the value of the external adult characters. Full details will be published in due time, including synopses based on adult characters. From Williston's description and two figures of the head, it appears that *Acroglossa hesperidarum* Williston does not belong in the *Spallanzania* group, and that a mistake has been made in labeling the type specimen of that species.

TWO HUNDRED AND EIGHTY-FIRST MEETING,

DECEMBER 3, 1914.

The 281st regular meeting of the Society was entertained by Mr. W. D. Hunter in the Sængerbund Hall, December 3, 1914. There were present Messrs. Abbott, Baker, Barber, Böving, Busck, Caudell, Coad, Crawford, Cushman, Duckett, Ely, Gahan, Greene, Heidemann, Heinrich, Hunter, Hutchinson, Isely, Knab, Kotinsky, McIndoo, Middleton, Parker, Popenoe, Rohwer, Rust, Sanford, Schwarz, Shannon, Simanton, Townsend, Van Dine, Walton, Webb, White and Wood, members, and Messrs. John E. Dudley, Jr., G. L. Garrison, H. G. Ingerson, R. W. Morland and Mitchell Phillips, visitors.

Mr. E. W. Rust and Mr. Dwight Isely were elected to active membership and Mr. A. F. Satterthwaite to corresponding membership.

The following officers were elected for the ensuing year: President, Mr. A. N. Caudell; 1st Vice-president, Mr. C. R. Ely; 2nd Vice-president, Mr. E. R. Sasscer; Corresponding Secretary-Treasurer, Mr. S. A. Rohwer; Recording Secretary, Mr. A. B. Gahan; Editor, Mr. J. C. Crawford; additional members of the Executive Committee, Mr. Schwarz, Mr. Quaintance and Mr. Marlatt.

To represent the Society as a Vice-president of the Washington Academy of Science, Mr. W. D. Hunter.

The following papers were read:

ON THE OCCURRENCE OF AN INTERMEDIATE IN APHIS POMI DeGEER.

(With Plate X)

By W. F. Turner and A. C. Baker.

The family Aphididæ presents many problems for the attention of the student of bionomics which are presented by no other similar group of insects. This, for the reason that the majority of the insects composing this group confine their feeding to definite host plants; that many of them cannot, or at least, ordinarily do not complete a year's cycle without the aid of two different species, and usually genera or even families of host plants; that several distinct forms of adults occur during one year's cycle; and finally that two or even three modes of reproduction may occur in the same period.

In the present paper we are concerned only with the last two items. In general, the adult forms may be classified in one of the following groups: First, the stem-mother, which hatches from a hibernating egg, or less often, is born in the fall and itself hibernates. It is parthenogenetic and may produce either living young or eggs. Second, the summer forms, either alate or apterous. Here any one of a variety of conditions may exist. The alate forms may occur promiscuously throughout the summer, or they may be confined to certain generations. In the latter event they may occupy those generations in which they occur to the exclusion of the apterous form, or may share the gener-

ation, in which case we have two very different forms, sisters or at least cousins, whose purpose in the economy of the insect may be as widely separated as their forms. Like the stem-mother these forms are parthenogenetic and like them, again, they may be viviparous or oviparous. This group may comprise from one to twenty or more generations. Finally there occur the sexes; females mate with males and produce eggs.

The matter is further complicated by the fact that there are countless variations of these general types, usually evolved in conjunction with some peculiar mode of life in a particular species, or group of species, or occurring in order to aid certain species to pass through adverse climatic conditions occurring during the year's cycle; for example, certain subterranean and gall inhabiting forms, and the flabellate form of *Chaitophorus testudinatus* Thornton, in which stage the insect passes through the warmer period. However, these different forms may be further combined into two groups, alate and apterous if the general form be the standard, or parthenogenetic and sexual when classified according to the mode of reproduction. To confuse matters still further, several observers have recorded, during the past thirty-five or forty years, adult forms which hold an intermediate position between the two groups, whichever classification be used.

What appears to be the earliest record of such an intermediate form is that made by Fatio (1876) in *Ph. vastatrix*. He speaks of a "pupa" which deposited (sessuali) eggs on the roots. This pupa was undoubtedly an intermediate. Maxitz (1893) describes two anomalous "pupæ" in this species, which in general resembled true pupæ, but had only foldings of the skin to represent wing pads. He believed these to be fully matured individuals, not pupæ arrested in development but intermediates between the apterous root form and the pupa. In this same species Stauffacher in 1907 noted observations on "pupæ" which possessed the "corsaletto" found usually only in the alate insects. In 1908 and again in 1912, Grassi and Foa recorded observations on intermediates, accompanied by quite detailed descriptions of several specimens, or groups of specimens. They state that their observed forms can be arranged in a series from apterous to alate. All of these intermediates with one exception, were virginoparæ, the one exception being a sexupara.

In other *Phylloxera* Dreyfus (1889) described intermediates (calling them apterous) in *coccinea* Drey. *punctata* Licht., and *rutila* Drey. He states that he observed apterous sexuparæ with eyes composed as in the alate, or better as in their pupæ and with all three ocelli present. He also observed in *rutila*, "pupæ" with the "corsaletto" later found by Stauffacher in *vastatrix*, as already recorded.

Grassi Foa (1908) also found intermediate sexuparæ in *Ph. Danesii.*

Among other aphids, Nüsslin observed the normal occurrence of intermediate sexuparæ in *Mindarus.* Mordwilko described intermediates in *Tetraneura cærulescens* with antennæ of six segments and compound eyes of 6–10 facets in one form, and well developed compound eyes in another, neither having any trace of wings. In *Dryobius roborsis* he describes a viviparous female with rudimentary wings and the dorso-ventral (alary) muscles and the longitudinal muscles of the thorax rudimentary or degenerated. He did not observe the offspring of this form.

Börner (1908) found these forms in various species of the Chermesidæ. He failed to observe the offspring, but apparently considers the adults as virginoparæ.

In so far as observations on the offspring were noted these records may be divided into groups. It will be noted that all of these observations have been made in species with very specialized life cycles, and that this form occurred in the generation in which sexuparæ also occurred. All the forms observed in Chermesidæ by Börner, and with one exception, all those observed in *Ph. vastatrix* by Grassi and Foa, were virginoparæ, that is, forms producing a large number of eggs which give rise to parthenogenetic aphids. These virginoparæ are normally all apterous at this time of year. The remaining records state that the adults were sexuparæ. The majority of the sexuparæ in the species under observation are alate, but apterous forms have been described in most, if not all of them. These conditions have given rise to various theories, which attempt to explain them.

Balbiani appears to have been the first to discover apterous sexuparæ (in *Paraphylloxera glabra*). He believed that these insects were alates in which sexual maturity preceded full somatic development, in other words, that while sexually mature, the insects were still in the larval form. Dreyfus believed that his observations of intermediates confirmed this theory. Börner considered that the apterous and intermediate sexuparæ of these two writers had the same value as his intermediates (which were viginoparæ). He believed, however, that they were merely intermediates between the normal virginoparæ and sexuparæ and were fully mature individuals. Mordwilko interpreted his intermediates in *Tetraneura cærulescens* in like manner.

Later (1909) Börner stated that, contrary to the theories of Balbiani and Dreyfus, intermediates are not larvæ, since they pass through four moults and attain, with the exception of wings, the more important alate characters. However, he makes a fundamental distinction between the intermediate virginoparæ of the

Chermesinæ and of *Ph. vastatrix*, and the intermediate sexuparæ of the other *Phylloxera*. The first he classes simply as abnormalities, forms intermediate between types with diverse modes of reproduction, while the second would constitute a type to themselves, a true wingless form of sexuparæ, or one with the wings reduced.

Dr. Foa fails to agree with Börner, first, because there exist in certain forms, alate virginoparæ and one would suppose that the intermediate virginoparæ would group with these, like the sexuparæ with the alate sexuparæ; secondly, because the separation between virginoparæ and sexuparæ is not absolute, from the fact that some nymphs can become virginopara or sexupara, because virginosexuparous forms exist. She further states that if the intermediate forms of the grape *Phylloxera* were found mostly in the spring, one should admit that they represent a series of alate virginoparæ in the process of reduction, but having been recovered only in the time and place in which the pupæ of alate sexuparæ exist, one would be led to believe that they are allied to them. She believes that, for unknown reasons, the *Phylloxera* is able to change its destiny in different stages of its development and that if it should change it in the first or second stage it would still produce a normal individual, while if it determines itself in the fourth it will probably become an intermediate. The intermediate virginoparæ, therefore, would be considered as individuals, which, as far as the third stage were going to become apterous adults. At this point, however, there would come some change, which, while having an influence on the character of the individual, would not be able to modify the nature of the eggs, since this would probably have been already fixed. The intermediate sexuparæ would be, instead, individuals which were to become alate, which had changed their orientation in the third stage, when the nature of the eggs was already determined.

Dr. Foa appears to be the only worker who has recorded observations on the younger stages of these intermediates. She says that the last nymphal stage of this form, more or less resembles a pupa. She observed the moulting of two individuals. One of these, when adult, had wing rudiments slightly larger than the pupal pads, while in the second they were smaller.

During the past summer, in the course of a study of the life history of the green apple aphis (*Aphis pomi*, DeGeer), at Vienna, Virginia, we made numerous observations on an intermediate form. The insects were reared on small seedling apple trees, in pots, each plant being covered by a lantern globe cage. Alate forms were of very frequent occurrence during the summer and,

in so far as it was possible, we bred the progeny from alate and apterous mothers in all cases. This necessitated the handling of a large number of experiments, there being at some periods as many as two hundred and fifty running simultaneously. It was found to be impracticable, under these circumstances, to select only the first and last born to represent each generation, as appears to be the usual custom. Consequently, we allowed two sisters, or cousins, as the case might be, in one generation, to produce the next and reared from a few to as many as sixty insects to maturity in every case, selecting our mothers for the next generation when they had reached the adult stage. This method has one great advantage over the other, in that it provides an abundance of bred material for further study.

In these experiments we obtained an adult form quite distinct from any of the normal adults of the species. This adult was an intermediate between the alate and apterous vivipara, or rather it is an alate with a tendency to degenerate to the apterous condition.

In the fourth or last nymphal instar, aphids which will become alate are strongly differentiated from the earlier stages and from the corresponding stage of the apterous form (fig. *m*). The thoracic segments are more clearly differentiated from each other and from the abdomen. The prothorax is narrow with nearly straight margins, while the proximal angles of the mesothorax form two prominent, rounded shoulders. The entire body is more narrow and elongated. The meso- and metathorax bear large wing pads. The color also varies in this form, the head and thorax being orange yellow with a rosy bloom, while in apterous insects they are yellow-green, concolorous with the abdomen. The wing pads are dark gray in color. Because of its resemblance to that form in the metabola, we follow the general custom and call this stage a pupa. It should be stated, in this connection, that the possession of wing pads also pertains to the third nymphal instar of this form, but in this case they are very small and their presence is not accompanied by any of the other special characters noted.

The fourth nymphal instar of this intermediate is apparently identical with the pupa of the normal alate aphid. The measurements of the antennal segments, the cornicles and the posterior tibiae are the same for both. In one case of five pupal moults mounted on a single slide, four being from insects which became normal alates and one from an intermediate, we were unable to separate the moults from each other. In handling the insects we usually transferred the "potential" alates to new plants, in the pupal stage. In no case of the selection and transfer of these

pupæ did we have any suspicion that they would prove to be anything but normal alate insects. Yet in several cases the adults were intermediate.

Upon becoming adult, however, the intermediate, at a casual glance, appeared to be apterous. In fact, it required close examination with a hand lens to perceive that it was not. The darker color of the head and thorax was lost, and instead of being black, as in the normal alate, it was of a uniform green with the abdomen, as in the apterous forms. Moreover, the shoulder of the mesothorax tended to flatten out, approaching the more uniform line of the apterous adult.

In the true alates, the wing venation was found to grade from the most complete nearly to the most reduced type known in aphids. (Exception should be made of one or two species recently described in which all veins, except those forming the stigma have been eliminated) (figs. *b–d*). The great majority possessed the most complete type, while only a small minority had the more specialized venation. The wings of intermediates which approached most nearly to the alate conditions were provided with even fewer veins, if they could be called such, than were any of the normal alate insects (fig. *e*). They were usually smaller than the wing pads of the pupæ, approximating the pads of third instar. This character varied greatly, however, forming with the character of the venation, a nicely graded series between the alate and apterous condition (figs. *f–k*).

It is to be expected, if the wing condition of these intermediates were a true reduction and not a mere accidental abortion, that it would be accompanied by a corresponding degeneration in the alary muscles. Such is found to be the case. In all of the specimens figured in the plate both pairs of dorso-ventral and longitudinal muscles were reduced nearly to the apterous condition. In specimen No. 1041, the form most nearly approaching the alate in wing condition, the large dorso-ventral muscles were reduced but little. In No. 910, which closely approximates the apterous form, these muscles were found to be almost exactly as in the apterous condition. In the intervening forms they were reduced almost to the apterous condition, being slightly larger in No. 999 than in the others.

While the antennal measurements vary considerably in the intermediate form, there is no appreciable difference in the average measurements of three adult types, nor does there appear to be a greater variation within the intermediate than is found within the apterous and alate forms. This is true, also, of the measurements of the cornicles and posterior tibiæ.

The variation in one antennal character, however, well shows the intermediate condition of our new form. No sensoria are

present on the third antennal segment, in apterous adults (fig. *r*), while in the alate insects this segment bears from four to eight of these sensoria, both the average and the mean being six (fig. *n*). These sensoria are large and generally of uniform size. Moreover, in the vast majority of cases, the numbers on the two antennæ are equal. In nine intermediates, this segment bore from four to six sensoria, the average being slightly under five per antenna and the mean, four. In seven out of the nine cases the numbers on the two antennæ were not equal. Moreover, these sensoria were very unequal in size. In some cases they were all large, though never as large as in alate insects, in some small, while in still others they varied greatly in size, the distribution of the small ones also varying (figs. *o–q*).

This form occurred in sixteen different experiments with a known total of thirty individuals. The first occurrence was in the third generation, on May 29, and the last in the twelfth generation, on August 26. It occurred in at least one experiment in all of the intervening generations, with the exception of the fourth and ninth. Of these sixteen lots, thirteen were produced by apterous mothers and three by alate. In only two cases did intermediates occur without the presence of alate sisters.

Eleven of these series reproduced normally, the other five dying before reproduction took place. All eleven series produced apterous offspring and three of them also produced alate forms. In two cases single individuals brought forth progeny, some of which became apterous and some alate. This polymorphic reproduction is of quite common occurrence in this species among both alate and apterous mothers. All of the young were perfectly normal and in several cases we were able to carry the descendants through several generations (in the case of the earliest through thirteen) to the sexual forms.

In 1912 Webster and Phillips recorded the occurrence of a similar form produced under similar conditions in *Toxoptera graminum*, a species in which, also, the majority of the summer form are apterous, but in which alate individuals occur quite frequently. They stated that they observed one instance in which a puparium produced six young. Apparently they did not rear these young. The note continues. "The cauda of this individual resembled that of an adult insect and the wing pads were aborted, the abdomen being much broader than that of the normal pupa."

Through the kindness of Professor Webster, we have since examined this specimen (mounted on a slide) and find it to correspond, as far as reduction is concerned almost exactly to our intermediate. The wing muscles are very much reduced;

the cauda is that of the adult form; and the antennæ are armed with sensoria as are the alate adults, there being four on the right and two on the left.

We have also noted an intermediate in *Aphis rumicis*, corresponding closely to that in *A. pomi*, and in a species of *Phylloxera* on hickory we have observed one specimen with wings about half the normal size.

Hunter (1909) and again Webster and Phillips have described forms in *T. graminum*, which vary between the sexual and parthenogenetic females. Some of these vary in outward form, between the true female and the alate agamic female; others between the true female and the apterous agamic. Some contain only eggs, others produce both eggs and living young.

We believe that all of these intermediates are of like value with that which we have found in *A. pomi*, that is, they all developed toward the alate condition until the end of the third instar, during which stage the pupal form is determined. In the fourth, or pupal instar, however, they tended to progress to the apterous condition. We find no evidence to support Dr. Foa's contention that insects primarily designed to become apterous may later tend to become alate, nor can we agree with Börner in his classification of these intermediate forms. The only condition which necessitates such explanations is that in which the intermediates are virginopara, while normal virginopara are apterous. Has not too much stress been laid upon this distinction between virginoparæ and sexuparæ? Dr. Foa, herself, states that she has observed virgino-sexuparæ, which would indicate that the line of demarcation is not strictly drawn, and other authors appear to believe that the intermediate virginoparæ are intermediate in position between virginoparæ and sexuparæ.

It is generally accepted that the apterous aphid is a more specialized type, which has been derived from the alate. If this is true, it would seem that the tendency in aphids is to eliminate the wings. At the same time, there would appear a degeneration of secondary alate characters, such as the sensoria on the third antennal segment, in species like *A. pomi*. In support of this theory attention is called to the fact that in *A. pomi* we have been able to breed the insects from the egg stage to the egg stage without the intervention of any alate generations.

Moreover, the primitive aphids must have been oviparous insects, reproducing sexually. Variations from this type would be the tendency to eliminate males and to transform from ovipara to vivipara. In some species these variations have been followed to their logical conclusions with the apparent elimination of both males and oviparous reproduction. In other cases this has been

partially accomplished, in that, under the proper climatic conditions, males and eggs do not appear in certain species while in colonies of the same species living under other conditions they do occur.

Granting the above premises, we believe that in these intermediates we have to do solely with transitional forms between more primitive conditions on one hand and more advanced conditions on the other. We feel confident also, that all these intermediates are of equal value. The very fact that variants have been discovered in so many different species, having such diverse habits, seems to us to preclude the possibility that these arise from different fundamental causes. The only difference is that the forms in *A. pomi* and similar species and the intermediate sexuparæ of various *Phylloxera* are varying in one characteristic, the elimination of wings, while the virginoparous forms in *Ph. vastatrix* and in the Chermesinæ are varying in two characters; the elimination of wings and the elimination of sexes. The intermediates described by Hunter and by Webster and Phillips fall into at least two classes, the elimination of wings and the elimination of ovipara. Some of the forms are intermediate in both groups, some only in one. It is possible, also, that there is here, a variation between sexual and parthenogenetic reproduction, but as the offspring were not reared this point cannot be determined.

We feel confident that, in the final analysis, these forms are not the result of promiscuous variations, but of deviations along definite lines, which are uniform for the entire family; that changes in outward form are always from alate to apterous; and that variations in the mode of reproduction progress from sexual to parthenogenetic and from oviparous to viviparous.

If we are correct in this matter then we are dealing with a group of insects which are at present in an unstable condition and in the various intermediates we are observing the steps by which the more advanced conditions are attained.

BIBLIOGRAPHY.

(1) Balbiani, (1884) Le Phylloxera du chene et le Phylloxera de la vigne. Paris, 1884. (Gauthier-Villars imprimeur-libraire.)

(2) Börner, C., (1908) Eine Monographische Studie uber die Chermiden. Arbeit. a. d. Kais. Biol. Anstalt. Bd. 6, Heft. 2, p. 45.

(3) Dreyfus, L., (1889) Neue Beobachtungen bei den Gattungen Chermes L. und Phylloxera Boyer de Fonse. Zool. Anz., No. 300.

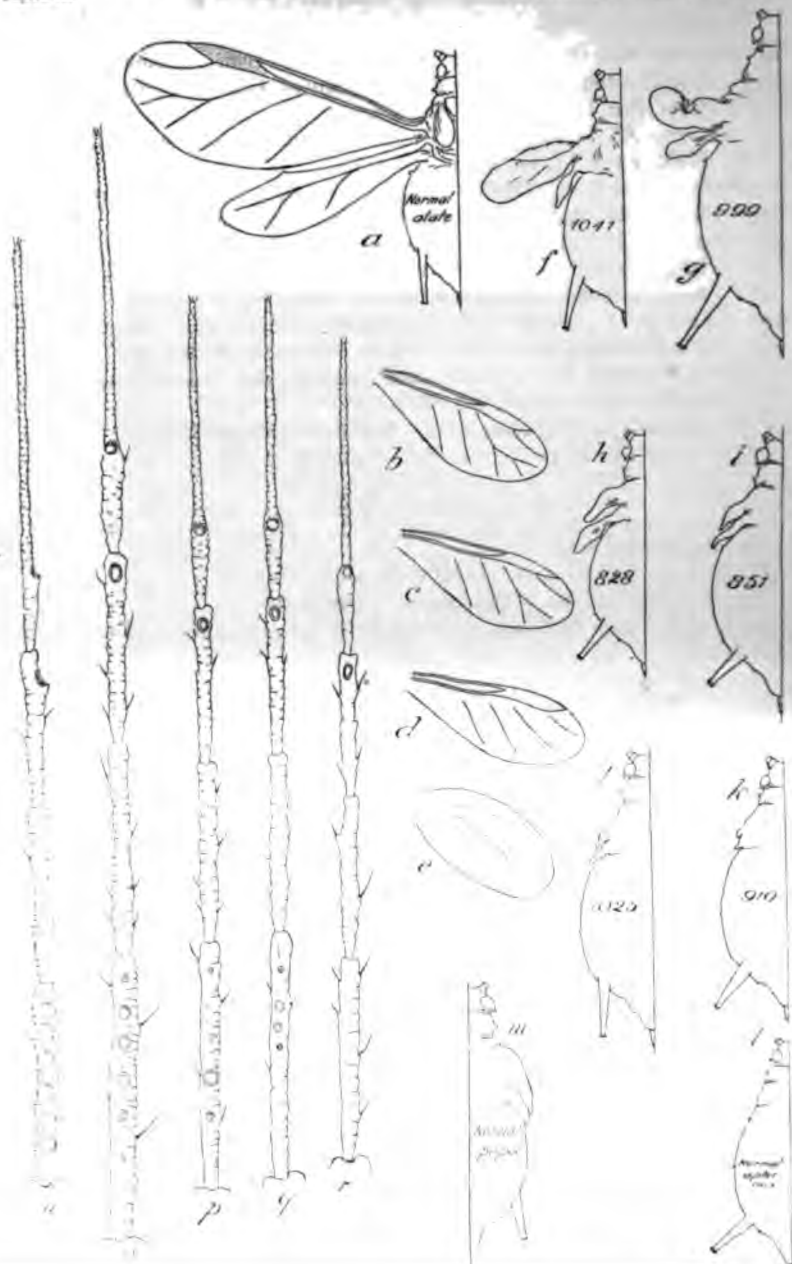
(4) Fatio, (1876) Le Phylloxera dans le canton de Genéve d' août 1875 à juillet 1876. Rapport au département de l'intérieur du canton de Genève. 1876.

(5) GRASSI and FOÁ, (1908) Madri radicole con caratheri ninfali. Rendi. della Regio. Accad. du Lincei, Classe de Scienze, vol. XVII, Ser. 5ª, Sem. 2, p. 349-359.
(6) HUNTER, S. J., (1909) The Green Bug and its Enemies. Bull. Univ. Kans., vol. IX, no. 2, pp. 108-116.
(7) MORDWILKO, A., (1909) Beiträge zur Biologie de Pflanzenläuse, Aphididae Passerini. Biol. Centrabb., Bd. 29, No. 4, p. 85.
(8) MORITZ, F., (1893) Beobachtung und Versuche, betreffend die Reblaus, *Ph. vastatrix* Pl. und deren Bekämpfung. Arbeit. a. d. Kais. Gesund., Bd. 8, p. 532.
(9) NÜSSLIN, O., (1909) Die neureen Ergebnisse und Aufgaben der Chermes-Forschung. Zool. Zeit., Bd. XVI, N. 21, 22.
(10) STAUFFACHER, HCH., (1907) Zur Kenntnis der *Phylloxera vastatrix*. Zeits. f. Wiss. Zool., Bd. 88, p. 135.
7 (11) WEBSTER and PHILLIPS, (1912) The Spring Grain-Aphis, or "Green-Bug." U. S. D. A., Bu. Ent. Bull. 110, p. 81.

EXPLANATION OF PLATE X.

Fig. A, Normal alate.
Figs. B-D, Variation in venation in alate wings.
Fig. E, Intermediate wing; greatest development.
Figs. F-K, Intermediates, showing series between alate and apterous condition.
Fig. L, Normal apterous.
Fig. M, Normal pupa.
Fig. N, Antenna of normal alate, showing sensoria on third segment.
Figs. O-Q, Antennæ of intermediates, showing degeneration of sensoria.
Fig. R, Antenna of normal apterous aphid, showing absence of sensoria on third segment.

Mr. Barber objected to the term "adults" being assigned indiscriminately to the reproductive stages of the aphids by Messrs. Baker and Turner. He believes that the aphids should be looked upon as reproducing more through an extreme form of pædogenesis than as simply agamic females, but that it is very hard to draw a line between simple parthenogenesis and its more complex type that is called pædogenesis. He believes that the term "adult" is more strictly applicable to forms in which less divergence is found from the normal bisexual mode of reproduction. This normal sexual reproduction is impossible in the so-called agamic "adults" of the aphids which might be regarded as larvæ so similar in structure throughout all their stages to the true adults


Normal alate
a
1041
f
999
g
b
c
d
e
h
828
i
851
1025
k
910
m
l
n
p
q
r

as to be even capable of acquiring wings, an idea which he had previously suggested before the Society (Proc. Ent. Soc. Wash., vol. 15, p. 35). He is not sufficiently familiar with the literature on the aphids to cite references on this point, but in a verbal discussion with Dr. Wm. M. Wheeler he received the impression that the present accepted explanation of the viviparous reproduction of the aphids is on the line pf pædogenesis.

THE FAMILY ŒSTROPHASIIDAE AND OTHER NOTES.

(AUTHOR'S ABSTRACT.)

BY C. H. T. TOWNSEND, *Bureau of Entomology.*

The family divides into the subfamily Ormiinæ, which equals the family Phasiopterygidæ Townsend (1912); and the subfamily Œstrophasinæ, the latter evidently including *Phasiops* Coquillett as judged on adult characters. The former subfamily possesses eggs which are microtype at time of fertilization but develop in utero to macrotype and disclose in utero a highly specialized planidium type of maggot indicating most likely a parasitism on ant or wasp pupæ, the maggots of *Ormia* possessing heavy strongly-hooked talons on the ventral aspect of the second segment. *Œstrophasia* has recently been demonstrated to deposit a microtype egg of a distinct character from any hitherto known, indicating noncommunity of origin with the masiceratid stocks. Its maggot is also of distinct character from the masiceratid maggot, and while greatly contrasted with the ormiine maggot is evidently of common family origin therewith. Three genera are so far known in each of the two subfamilies, *Phasiopteryx australis* Townsend (1912) becoming the type of a new genus. Adult characters mark this family off conspicuously from the rest of the Muscoidea, and they are well supported by the reproductive and early-stage characters. The family is evidently an ancient one, with a remnant persisting exclusively in America and no close existing relatives. The most nearly related group known appears to be the tribe Myiophasiini, but it is much too far removed on adult and all other characters from the Œstrophasiidæ to be included therein. The family name Œstrophasiidæ was proposed by Brauer and von Bergenstamm in 1889. Full details, including adult-character synopses, will be published later.

The European *Winthemia quadripustulata* Fabricius does not occur in America, the American forms being easily separated as

distinct, among which are thus far recognized *militaris* Walsh, *deilephilæ* Osten-Sacken and *datanæ* Townsend. The original descriptions closely followed will separate these species. *Spallanzania hebes* Fallen and *Cnephalia bucephala* Meigen do not occur in America; the species *finitima* Snow being congeneric with *ruficauda* Townsend, while *pansa* Snow is a distinct American species of *Spallanzania* as opposed to *Cnephalia*. Furthermore *Gonia capitata* DeGeer is not American, *frontosa* Say being valid, as well as several other easily separable American species.

The following papers have been accepted for publication:

NOTES ON IPIDÆ WITH DESCRIPTION OF A NEW SPECIES.

By A. D. Hopkins.[1]

A subdivision of the genus *Ips* DeGeer represented by *Ips* (*Tomicus*) *concinnus* Mann. is distinguished from the other divisions by the subcompressed antennal club with the basal joint short and with two broadly procurved annulations on the anterior face. The elytral striæ faintly or not at all impressed and the punctures not or but slightly coarser than those of the interspaces; the declivity steep, concave and with three marginal teeth each side, the third cylindrical and prominent. The marginal teeth are coarser in the male than in the female.

There are three species distinguished as follows:

b1. Pronotal and elytral punctures fine.
[Oregon to Alaska, in *Picea sitchensis*.]
concinnus Mann.

b2. Pronotal and elytral punctures moderately coarse.
Elytra with striæ punctures not distinctly coarser than those of the interspaces.
[Berkeley, California, in *Pinus radiata*, Apr. 18, 99, Hopkins collector, Hopk. U. S. No. 3c. Type No. 7461 U. S. N. M. California to Idaho, in *Pinus radiata* and *Pinus contorta*.]
radiata n. sp.

Elytra with striæ faintly impressed and the punctures coarser than those of the interspaces.
[[illegible], in *Pinus*.]
mexicanus Hopk.

(Proc. Ent. Soc. Wash., Vol. V, No. 1, 1902, p. 75.)

[1] This is a contribution from the Bureau of Entomology, Branch of Forest Insects.

DESCRIPTIONS OF BRACONIDÆ

By S. A. Rohwer, *Branch of Forest Insects, Bureau of Entomology*

Genus Allodorus Foerster.

This genus, which has not heretofore been recorded in the Nearctic fauna, may be separated from *Triaspis* Haliday by the presence of at least a stump of the cross vein in the anal cell, by having the fourth and fifth tergites narrowly visible, and by the more or less convex venter. (In *Triaspis* the venter is concave.)

Characters Common to the Nearctic Species.

Black; legs ferruginous except the brownish posterior tibiæ and tarsi; wings hyaline, venation dark brown or black; front shining, sparsely punctured; mesoscutum and meso-prescutum shining, sparsely punctured; notauli foveolate; the base of the propodeum with two shining areas; posterior face irregularly reticulate; the depressed area between the mesoscutum and scutellum with a strong median carina; mesepisternum shining, sparsely punctured; depression before the carina between the mesepisternum and the mesepimeron foveolate; third antennal joint a little shorter than the second; ocelli in a little less than an equilateral triangle; the postocellar line much shorter than the ocellocular line; ovipositor about the length of the abdomen.

Table to the Nearctic Species

Face shining, very sparsely punctured; supraclypeal foveæ shallow; clypeal suture uniformly strong; the striæ of the third tergite straight, parallel and covering the entire surface .... *fiskei* (Rohwer)

Face more closely punctured laterally and more or less rugulose medially; supraclypeal foveæ strong; clypeal suture poorly defined medially; striæ of the third tergite oblique laterally, and more or less concentric apically with a median area which is usually nearly transversely striate -*tomoxiæ* Rohwer

Allodorus fiskei (Rohwer). *Triaspis fiskei* Rohwer, Proc. U. S. Nat. Mus. Vol. 45, No. 1991, 1913, p. 535.

Allodorus tomoxiæ new species. Length 4.5 mm. for both sexes. The female agrees with the above mentioned characters. The males have the head slightly paler than the females often having the face entirely reddish yellow; otherwise they agree with the females.

Falls Church, Virginia. Described from three females (one type) and three males (one allotype) recorded under Bureau of Entomology number Hopk. U. S. No. 10122, which refers to note stating that this species is parasitic on the larvæ of *Tomoxia lineella* feeding in brashy wood of *Liriodendron* stumps. Material collected and reared June 22, 1912, by S. A. Rohwer.

Type: Cat. No. 19096, U. S. N. M.

GENUS NEOPHYLAX Ashmead.

This genus belongs to the Agathinæ as defined by both Ashmead and Szepligeti. In Szepligeti's table to the genera of the Agathinæ it runs to the genus *Megagathis* Kriechbaumer but differs from the description of that genus in having the depression above the antennæ with a margining carina and in having the second segment without any sutures.

Neophylax snyderi Ashmead. *Female:* Length 7 mm. Ferruginous; antennæ, extreme apices of the posterior tibiæ and the posterior tarsi, black; wings hyaline, slightly dusky, venation yellowish; costa and stigma black. Prescutum defined by foveolate furrows; depression between the scutum and the scutellum with three longitudinal rugæ; the dorsal and posterior aspects of the propodeum separated by a sharp carina, the dorsal aspect with four longitudinal carinæ which define three rectangular areas, the median one narrower than the lateral ones, the posterior aspect with five rectangular areas the median one slightly broader, dorsally; abdomen shining, second tergite nearly as long as the first.

Luebo, Congo. Described from one female collected by T. W. Snyder.

Type: Cat. No. 14162, U. S. N. M.

Macrocentrus ægeriæ, new species. Of the described species this is more nearly allied to *mellipes* Provancher, but may be distinguished from that species by the sculpture of the prescutum.

Female: Length 8 mm.; length of the ovipositor 8.75 mm.; length of the antennæ 9.5 mm. Anterior margin of the clypeus broadly, gently, arcuately emarginate; head below the antennæ shining, with sparse, widely separated punctures which become closer in the median area, above the antennæ; posterior orbits shining, practically impunctate, except for the setigerous punctures; postocellar line about one-sixth shorter than the ocellocular line; scutum and prescutum shining, the scutum medially with a few large punctures; notauli well defined, foveolate, reticulate where they meet; scutellum shining, with a few distinct setigerous punctures; depressed area between the scutum and scutellum with eleven strong rugæ; propodeum transversely irregularly striate, anteriorly the striations are finer and there is a tendency towards reticulation; mesepisternum shining with uniform, widely separated distinct punctures; first and second tergites with longitudinal striæ; on the first the striæ form an elliptical-shaped median area; the third and following tergites practically impunctate; second abscissa of the radius but little shorter than the first transverse cubitus; nervulus post-furcal by half its length. Black; palpi and tegulæ brownish; mesosternum, lower part of the mesepisternum, spot on the mesepisternum and legs except the posterior tibiæ and tarsi, rufous; the apices of the four anterior legs paler; the posterior tibiæ and tarsi brownish black; a narrow pallid band at the base of the tibiæ; wings hyaline, iridescent, venation brownish.

Greenville, South Carolina. Described from one female recorded under Bureau of Entomology number Hopk. U. S. No. 11128*a*, material reared May 5, 1913, by Carl Heinrich. This species is parasitic on the larva of (*Sesia*) *Ægeria castaneæ* Busck.

Type: Cat. No. 19085, U. S. N. M.

Actual date of publication, March 16, 1915.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVII	1915	No. 2

Two Hundred and Eighty-Second Meeting,

January 7, 1915.

The 282d regular meeting of the Society was entertained by Prof. A. L. Quaintance at the Sængerbund Hall, January 7, 1915. There were present 48 members and 21 visitors, this being the largest attendance ever recorded at a regular meeting. Those present were Messrs. Abbott, Baker, Barber, Bishopp, Blakeslee, Böving, Busck, Caudell, Champion, Coad, Craighead, Crawford, Cushman, DeGryse, Van Dine, Ely, Fisher, Gahan, Gill, Greene, Heinrich, Hood, Hopkins, Howard, Hunter, Hutchinson, Isely, Kelly, Knab, Kotinsky, McIndoo, Middleton, Phillips, Pierce, Quaintance, Ransom, Rohwer, Rust, Sanford, Schwarz, Shannon, Siegler, Simanton, Snyder, Strauss, Townsend, Turner, Walton, Webb, Wood, members, and Wm. Davidson, R. J. Fiske, R. M. Garner, E. W. Geyer, R. W. Howe, C. Gordon Hewitt, H. G. Ingerson, A. C. Johnson, J. W. McCulloch, F. L. McDonough, Jas. A. Nelson, Wilmon Newell, A. H. Pottinger, H. K. Plank, H. B. Scammell, E. Schramm, F. L. Thomas, Delmar Webb, R. L. Webster and Carrington B. Williams, visitors.

The address by the retiring President was discussed by Dr. Howard, Dr. Hopkins, Mr. Bishopp, and Prof. Quaintance, each of whom complimented the author highly upon the excellence of his paper. Upon request Dr. C. Gordon Hewitt discussed the address briefly. He was of the opinion that medical entomology had done much toward bringing the science to popular attention and favor as in its various phases it made a more direct appeal to all classes of people.

A vote of thanks was unanimously tendered Mr. Hunter by the Society.

Mr. Wilmon Newell of Texas, Mr. C. B. Williams of England, and Mr. R. L. Webster of Iowa—visitors—were each in turn called upon by the President and responded with a few appropriate remarks.

The retiring President gave the following address:

SOME OBSERVATIONS ON MEDICAL ENTOMOLOGY.

By W. D. Hunter.

It is altogether likely that no branch of entomology will develop as rapidly in the next few years as that which deals with transmission or conveyance of diseases. Medical entomology brings the importance of a knowledge of insects home to large new groups of persons, physicians and sanitarians, and thus greatly enlarges its clientele. Until recently it was the producers of crops who were principally concerned, but more and more, as new discoveries are made, entomology comes into importance in connection with the personal welfare of man. There therefore seems to be some little timeliness in observations on the present status of our knowledge of disease transmission by insects, and on possible extensions of the field. The theme also seems to be pertinent on account of the fact that this Society probably contains as great a proportion of individuals interested in medical entomology as any similar society in existence.

As a prelude attention will be directed to what may be called the biological significance of infectious diseases. This idea was probably first put into form by Lankester but was brought home to us by a former colleague W. F. Fiske. In a broad way the proper study of infectious diseases is essentially a study of parasitism. The principles involved, as Fiske states, are very similar to those which entomologists have been considering for many years. For instance there is an analogy between the human diseases and the parasites of the boll weevil. In this case there are numerous species of different families which exist on other species of insects which are dependent upon various plants. There thus exists a biocenose or complex and the boll weevil at the center may be affected by something which happens to a plant for instance which may occupy a place on the periphery of the complex. The same inter-relationships occur with the parasites of the Gypsy moth and other insects. If we should substitute

man for the boll weevil, or for the Gypsy moth, in one of these biocenoses, and substitute pathogenic organisms and their vectors for the parasites we would have a set of analogously interdependent relations. There is one striking difference. In the case of the parasites of the boll weevil the purpose of entomologists is to increase their efficiency by adding links in the chain or otherwise; while in the case of parasites of man the purpose is to break up the relations so that the attacks of the parasites against the host will be lessened. Notwithstanding this difference both efforts rest on the same foundation, that is, an intimate knowledge of the complicated relations between interlocking and inter-independent groups of animals.

The time has not arrived for the classification of the conditions under which insects may transmit diseases, as our knowledge is being extended almost daily and unsuspected conditions or sets of conditions are coming to light. For the present purpose, however, certain conditions which seem to be of importance in connection with disease transmission by insects will be mentioned, not so much in the way of a classification as an enumeration of the modes involved.

Undoubtedly the most important habit of insects which has a bearing on disease transmission is that of sucking blood. This is the basis for the transmission of the great majority of insect-borne diseases. There are probably many complicated interrelations involved. Among them seems to be the habit of certain parasites of man and other animals, such as the species of *Filaria*, to swarm in the peripheral blood during the time when nocturnal insects are active and the host is least in a condition to interfere with their attack. Of course some investigators explain this phenomenon on purely physiological reasons, that is, the supposed expansion of the sub-cutaneous capillaries when sleep begins which may allow organisms too large to reach positions immediately under the skin during the day to do so during the night. But we think it not too much to suppose, in view of what is known of the adjustments between other organisms, that the swarming in the peripheral blood is an adaptation to assist in establishing the necessary connection between two interdependent forms.[1]

Another consideration of importance in this connection is what may be called domesticity. This is of great importance, as F. Knab has pointed out,[2] in connection with such diseases as yellow fever, kala azar, and Chagas disease. It must be evident

---

[1] Manson, Patrick. Tropical diseases. A manual of the diseases of warm countries, 1914, 673.

[2] Knab, F. Journal of Economic Entomology, Volume V, p. 196.

that the closer the association between any insect and man the greater will be the likelihood of disease transmission, provided the other necessary conditions are fulfilled. Domesticity, therefore, is a condition which affects profoundly the phenomenon of disease transmission, and the importance of vectors in many cases at least will depend upon the degree to which their domesticity has been developed.

There is, however, a class of diseases, which is likely to become extended with future study, in which domesticity does not act as an important factor. Such diseases as spotted fever and tsutsugamushi are examples. The essential condition in such cases seems to be a natural contact with the reservoir of the disease, and accidental contact with man. The spotted fever tick is in no sense a domestic species. In fact, it is quite the reverse.[1] It decreases in numbers with the advent of man and with his operations in the fields. The tick probably acquires the virus of spotted fever from certain wild animals. A tick infected in this way happens to attach itself to man as it would to any other animal. The attachment is, therefore, to be looked upon as more or less an accident which is of importance by reason of the fact that it establishes a connection between man and the virus. Likewise tsutsugamushi fever has its reservoir in wild rodents and reaches man through the intervention of a mite, *Trombidium akamushi*, which attacks him when he goes into the fields.[2]

There are no very definitely established cases at present but it is likely that there will be found to be another class of diseases in which insects are of importance, where the essential condition is accidental contact with the pathogenic organism (instead of natural contact as in the case of spotted fever), and accidental contact with food. If cockroaches become definitely connected with tuberculosis, or similar maladies, as seems likely to be the case, they will present such a class as we believe will ultimately be found to be important.[3] Of course the importance of this mode of transference will be profoundly affected by such conditions as the abundance of the insects, and the viability of the pathogenic organisms.

Another class of cases is that of diseases which may be transmitted by insects which become contaminated by feeding upon or visiting the body discharges of invalids. An example of this is a species of *Oscinis* which seems to have developed a rather

---

[1] Hunter, W. D. and F. C. Bishopp. Bulletin 105, Bureau of Entomology, U. S. Department of Agriculture.

[2] Ashburn and Craig. Philippine Journal of Science, B. III, p. 1.

[3] Barber, M. A. Philippine Journal of Science, B. IV, p. 4.

special habit of visiting the external lesions of yaws.[1] It has been noticed that this insect will be found in considerable numbers on the lesions of patients in hospitals as soon as the bandages have been removed. Of course the house fly is the most conspicuous example of an insect which may be concerned in the transmission of diseases in this manner.

The last class of cases consists of those in which insects serve as intermediate hosts for cestode or nematode parasites. The parasitism of the hog by *Echinorhynchus hirudinaceus* is especially interesting because the insect concerned belongs to the order Coleoptera which is not generally associated with disease organisms. The necessary host for one stage of this parasite is the larva of some scarabæid beetle. In Europe the species of *Melolontha* and in this country species of *Lachnosterna* are involved.[2] The infestation of the swine is rather general and sometimes of grave importance on account of perforations and for other reasons. Occasional human cases are also recorded. This is another case in which the destruction of the insect intermediate host would result in the control of the disease. It is rather novel, however, because the destruction of white grubs is undertaken on account of the injury they do the crops, while ordinarily the destruction of intermediate insect host must be predicated upon the fact of disease transmission or the fact of direct annoyance to man. A similar instance is found in a tape worm of the dog (*Dyphylidium caninum*). In this case some insect is necessary for the development of the cysticercus stage of the parasite.[3] Usually it is a flea or louse which forms this function. As in the other case man is directly concerned to at least a certain extent, since Blanchard summarized not less than sixty cases which has been recorded in man up to 1907.

Among the strictly human cestode parasites, one of the most important is *Hymenolepsis diminuta*. In this case the necessary intermediate host for the cysticercus stage may be any one of several insects. This has been proven in species of the following genera—*Pyralis*, *Anisolabis*, *Ascis* and *Scaurus*.[4] Thus certain common household insects, like the flour moth, have relation to man which is frequently overlooked.

In this discussion we have purposely omitted the attack of insects against man in purely mechanical ways, such as myiasis, and have restricted ourselves to the cases in which the injury is not direct but indirect through infection by specific organisms.

---

[1] Nicholls, L. Bulletin Entomological Research, III, No. 14, 199.

[2] Ransom, B. H. Yearbook, U. S. Dept. Agriculture, 1905, 155.

[3] Castellani, A., and A. J. Chalmers. Manual of Tropical Medicine, 1913, 502.

[4] Id., 503.

Undoubtedly a great deal more will be learned about different forms of direct attack of insects against man, but it is safe to say that our knowledge of that subject is much more nearly complete than on the subject of transmission of disease organisms. We shall mention, however, that the most interesting case of a malady due to direct attack is tick paralysis which is just coming to be known. The attachment of a tick causes progressive paralysis ascending from the lower extremities until all parts of the body are involved. A peculiarity is that the motor but not the sensory nerves are involved. The disease evidently occurs in Africa, and Australia as well as in North America. That it is not uncommon is shown by the fact that 13 cases have occurred in the practice of a single physician in Oregon.[1] No virus has been found and the experiments of Hadwen and Nuttall show that it is not infectious. The malady appears to be unique but may be found to be the first representative of a special class of injuries caused by insects. We are aware that Hadwen and Nuttall[2] lean toward the theory of a specific causative organism and this is supported by what appears to be a definite incubation period in the tick. Our reasons for leaning toward the theory of nerve shock are the non-infectiousness of the disorder and the relation of the location of the puncture to the symptoms. At any rate it suggests that we are probably still ignorant of many reactions between man and insects in which the health of the former is involved.

Omitting tick paralysis for the present we may summarize the more important conditions involved in disease transmission as follows:

1. Blood sucking.
2. Domesticity.
3. Contact with reservoir and accidental contact with man.
4. Accidental contact with pathogenic organisms, and accidental contact with man.
5. Feeding upon and breeding in body discharges.
6. Functioning as necessary intermediate hosts for nematode or cestode parasites.

It is possible that several new groups of diseases in which insects are concerned will be found to exist. In the investigation of beri beri and similar diseases in recent years much has been learned about the effects on the system of the presence of toxins of various kinds, and by the absence of certain so-called vitamines.

---

[1] Temple, I. U. Medical Sentinel, XV, 507; see also Parasitology, VII, No. 1, 96.

[2] Nuttall, G. H. Parasitology, VI, 299-301; see also Hawden, Parasitology, VI, 283.

Is it not possible that the presence of insects in considerable numbers in food products may result in the formation of toxins, or at least increase greatly the natural tendency of the products to develop toxins? It is even conceivable that the work of some insect in the food product might result in the destruction, or reduction, of important vitamines. These speculations may be going rather far afield but one recent contribution to our knowledge seems to indicate the probability of a new class of maladies caused by insect secretions. Messrs. Seyderhelm,[1] working in Germany, have apparently proven that infectious aenemia of the horse, a widespread and mysterious malady, is caused by toxins secreted by the larvæ of the species of *Gastrophilus*. They made injections of extracts made from the larvæ of two species of the genus and reproduced conditions in experimental animals which appear to be identical with those of infectious aenemia. The toxin obtained, which they call oestrin, was found in experiments to be specific for the horse and non-pathogenic for other animals. It was even found that the toxin from *Gastrophilus hemorrhoidalis* is much more active than that obtained from *Gastrophilus equi*. The probability of the existence of a definite toxin was proven by numerous tests with chemicals and cultural methods which did not reveal any of the indications of plant or animal organisms which might be the cause of the reactions following the injections. These investigators went so far as apparently to cause the disease in susceptible animals through the agency of blood extracted from animals in which the disease had been induced solely by the injection of the toxin derived from the larvæ.

This phase of the discussion will be ended with a mere reference to the popular belief that the larvæ of *Chrysomyia* are responsible, probably through the formation of toxins, for the disease known as limberneck of fowls, and to Doctor Saunders' investigations in St. Louis which show various symptoms simulating those of poliomyelitis occuring in animals into the diet of which fly larvæ of various kinds have been introduced.[2] Whatever the outcome the work along this line which is now under way will add greatly to our knowledge.

We propose at this point to make a survey of some of the important diversities which present themselves in the nature and manner of disease transmission by insects. These include pathogenic organisms of widely different groups and striking diversity in the habits and systematic position of the insect vectors.

---

[1] Seyderhelm, K. R., and R. Seyderhelm. Arch. Exp. Pathol. u. Pharmak., XXVI, 1914, 149.

[2] Saunders, E. W. Journal St. Louis Medical Association, IX, No. 12, 385–389.

Among the bacterial pathogenic organisms transmitted by insects are those causing bubonic plague, anthrax, and typhoid fever. They represent, as far as the insect intervention is concerned, both accidental and obligatory hosts.

As is well known many of the striking diseases transmitted by insects are caused by protozoan parasites, among them malaria, sleeping sickness, nagana, leishmaniasis and numerous trypanosomiases. In these cases the usual function of the insect is that of a necessary intermediate host to permit the development of the causal organism through a certain stage. However, it is evident that mechanical transmission may occur in certain cases.

Among the nematodes, species of *Filaria* are conspicuous examples of pathogenic organisms transmitted by insects. In addition to the human disease caused in this way there is filiariasis of dogs caused by *Filaria immitis* transmitted by certain mosquitoes, and it is altogether likely that other diseases of this class will be discovered in the course of time. We may also mention the probable occasional dissemination of *Necator* by the house fly and the recent work of Fibiger which shows an apparent connection between a nematode carried by cockroaches and carcinomatous lesions in the internal organs of mice. The work is not all complete, but, nevertheless, may be said to be extremely suggestive of a possible new class of diseases in which the insect may be concerned.

Among the cestodes there are cases of the occurrence of insect intermediate hosts. Among them is the disease of dogs caused by *Diphlydium caninum* which is transmitted by fleas. The precise agency of flies in the transmission of the eggs of human cestode parasites has not been made altogether clear although numerous laboratory experiments show that such eggs are frequently devoured by flies and discharged in a viable condition. As a matter of fact the house fly and other species seem to have a rather special predilection for the eggs. What remains in this connection is to determine the extent of feeding on cestode eggs under natural conditions, but the laboratory experiments and the known habits of the house fly leave little doubt on this score and show clearly the facility of the dissemination of such eggs when devoured by flies.

It will be seen from the foregoing that insects are directly concerned in the transmission of diseases caused by organisms extending over four groups from the bacteria through the protozoa and the nematodes to the cestodes.

The diversity of the insect transmitters from a taxonomic standpoint is interesting. Examples are found in the mites in two families of ticks and in four orders of insects proper, namely Diptera, Hemiptera, Siphonaptera and Siphunculata. Even the

Lepidoptera and Coleoptera may be involved in special ways as has been suggested previously.

Various relations are found to exist between disease organisms and the insect host, among them the mechanical and special or obligatory relations.

It was supposed for sometime that the transmission of disease-causing organisms in which insects are the special intermediate hosts could only occur when the infection was derived and transmitted by the same stage. It appeared, for instance, that the persistence of disease organisms from the larval to the adult stage of the house fly would be impossible on account of the processes of histolysis and histogenesis in the pupal stage. Of course, in the best known examples of hereditary transmission of disease organisms, as by ticks, there is no such apparent barrier to the development of the parasite. Recent observations by Graham-Smith[1] and others have shown, however, that certain pathogenic organisms may persist through the pupal stage of the house fly so that we may have hereditary transmission by insects with complete as well as with incomplete metamorphosis. At any rate, the investigations have been carried far enough to indicate that spore-bearing bacilli like the *Bacillus* of anthrax can easily be carried through in this way. There is doubt as to whether non-spore-bearing bacteria will survive, but it is possible that they may do so in some cases.

The list of animals in which insect-borne diseases may occur is undoubtedly incomplete but it includes man, rodents, horses, cattle, dogs and birds. In fact, there does not seem to be any restriction on the list of hosts that may become infected.

In the modes of infection certain striking diversities are to be noted. For instance, the sucking of blood and its regurgitation, the contamination of food, and possibly the secretion of specific toxins.

The geography of insect-borne diseases may also be mentioned here. Although the majority of such diseases known are endemic in tropical and sub-tropical regions we have such noteworthy exceptions as typhus fever which may occur everywhere, and spotted fever in the northern part of the United States as well as such other widespread diseases as tuberculosis and pneumonia in which the function of the insect is altogether mechanical.

Such multifarious divergencies in the conditions and modes of transmission, in the functions of the vectors, and in the nature of the causal organisms involved lead us to enquire whether there is no end to the possibilities of insect connection with diseases, and must every disease the etiology of which is not known be

[1] Graham-Smith, G. S. Flies in relation to disease, 1913, 186.

considered as possibly carried by insects. Of course there is a limit to the possibilities and other modes of infection must be well considered. This leads us to mention a danger that confronts us, namely, a possible tendency to exaggerate the importance of insect transmission and overlook, even in cases where insects may be occasionally concerned, the greater importance of other modes of infection. The function of air, water, food and contact will always be important and the enthusiast would do well to weigh them deliberately. The danger of drawing conclusions is shown by the recent history of pellagra. Doctor Sambon evolved a theory of insect transmission which fitted very well into the known facts in the epidemiology of the disease. He found its geography, seasonal incidence, and other features to be explained by transmission by *Simulium reptans*. Its causative organism could not be found and was therefore probably protozoan and ultra-microscopic like that of yellow fever which is insect-borne. It occurs commonly in persons living near running water. Therefore its possible vector was an aquatic insect. It breaks out in the spring which suggests an insect most prevalent at that season. *Simulium* is a biting insect which lives in rapidly running water and is most abundant in the spring. Therefore *Simulium* was the transmitter. Many interesting details in this theory will be recalled by those who have had the pleasure of hearing the impressive statements of Doctor Sambon. Further work, however, shows the presence of pellagra in regions where *Simulium* does not occur and the whole theory appears to have been based upon a series of coincidences.

As a matter of fact there will always be considerable danger in conclusions based upon epidemiological findings. To find that the range of some insect coincides with the range of a disease especially if the insect meets other requirements is suggestive of some form of some important relation to the malady, but transmission experiments are quite necessary to prove it. It is obvious that the danger is greater in the case of diseases in which the causal organism is unknown. Where the organism is known the finding of it in the insect under suspicion is a simple and effective guard against error.

All of the foregoing is preliminary to some observations on urgent needs of the present which entomologists should hasten to fill. The whole study of insect-borne and possibly insect-borne diseases is hampered by a lack of sufficient knowledge of the insects involved. To illustrate, at one point in the work of the Thompson Pellagra Commission certain observations seemed to show that the head louse might be the vector. It would possibly explain the striking difference in incidence by sex better than any other insect. Exact knowledge about the abundance, habits,

and dispersion was needed but was it available? No one is making studies of the insect and one turned to the literature. Piaget is very satisfactory from the purely taxonomic viewpoint but the few remarks he makes on habits were evidently based largely on supposition. In fact, most of the statements go back to Leuckart's work published in 1863.[1] We find in it a mass of statements about epidemics of psoriasis in the middle ages, about kings and princes and high church dignitaries who succumbed to gross infestation by lice. This is all interesting enough and calculated to reassure us of our advance above the dark ages but it does not supply the information we desire. As a matter of fact entomology failed in this instance to furnish information demanded in the investigations of an important and mysterious malady. There are numerous cases in which exact knowledge of insects under suspicion of disease transmission is required. Some of them, like *Stomoxys*, are receiving attention but many others remain to be studied. Investigators in related fields, like those of the organisms found in the alimentary tract of insects and of the pathological phenomena connected with insect bites are doing much work, and entomologists working on the distribution, dispersal, habits and development of insects will have to bestir themselves most actively to perform their proper share in the great problems of human health. Consider the potential importance of the biting flies of the family Psychodidæ as suggested by the transmission of pappataci fever and verruga in other countries. Our knowledge of the North American forms is not sufficient to answer any one of scores of questions which may arise in relation to the carriage of disease. Other families of blood sucking flies like the Chironomidæ are in the same condition, and what do we know about the possible vectors among the American Hemiptera? The biological side is largely terra incognita. We know possibly as much about it as was known about geography when Columbus discovered America. The taxonomic side, though in a vastly more satisfactory condition, is far from thoroughly explored.

We digress at this point to note the vital importance of entomological knowledge in connection with the investigation of diseases that may be transmitted by insects. This was never more clearly shown than in the case of a recent investigation in the Canal Zone.[2] An equine disease caused by *Trypanosoma hippicum* was under investigation and a question was raised about the possible carriage of the organism by ants. As the investi-

[1] Leuckart, K. G. F. R. Die Menschlichen Parasiten, 1863.

[2] Darling, S. T. Tr. 15th Int. Congress Hygiene and Demography, Sec. V, 1913.

gator stated: "One can readily see the danger of our situation if ants acted as carriers of pathogenic micro-organisms, for it is absolutely impossible to keep them out of the house, and they get into food in spite of our efforts." Two series of experiments were performed to determine whether ants could carry *Bacillus typhosus*, either in their alimentary tracts, or on the surface of their bodies. It was found under certain conditions that infection of culture media could be brought about by allowing ants artificially infected to come in contact with it. Referring to the other experiments Dr. W. M. Wheeler makes the following statements:[1] "The other series of experiments gave negative results, for after dissecting ants that had been fed typhoid bacilli, neither these nor any other micro-organisms could be cultivated from the intestinal tract. From these results Darling proceeds to draw an erroneous conclusion which can only be due to ignorance of the anatomy and physiology of ants. He tested his ants for formic acid and found that two of the species with which he worked (*Camponotus zonatus* and *Tetramorium guineense*) contained 2.1% of this substance, and he believed that because its germicidal value is four times as great as that of carbolic acid, the "ants may effectually sterilize bacteria in their food." Though not definitely stated, it seems that Darling supposed the formic acid to be secreted in the alimentary tract of the ant, which is, of course, erroneous, and he seems to believe that this acid is generally present in ants, whereas it is produced only by certain genera and species."

After all but one side of the subject has been touched. We have dealt largely with insects in connection with diseases the exact nature of which is unknown and with an eye to the future. There remains the whole field of diseases in which insect agency is established. There are the malarial mosquitoes, ticks, and the house fly where the problem of control of disease is largely if not essentially the control of the vector. Here are large and immediate demands for entomological research. What may be expected is shown by recent work on the house fly. The first season it revealed a previously untried agent for the destruction of the immature stages in manure that exceeds the substances that had been used in cheapness, effectiveness, and in harmlessness to the manure as a fertilizer.[2] The second season this work yielded a trap which promises to do away with the use of chemicals altogether under many conditions and results in chemotaxis which will possibly be of great importance in the control of many species. In the work on malarial mosquitoes similar progress is

[1] Wheeler, W. M. Am. Journ. Tropical Diseases, II, No. 3, 163.
[2] Cook, F. C., et al. Bulletin 118, Bur. Ent., U. S. Dept. Agric.

most likely to be made. Such investigations give much to do but while we are engaged in supplying the immediate demands we should give heed to the inevitable future demands for complete information about the numerous insects fulfilling the requirements of blood sucking, domesticity or otherwise for the transmission or dissemination of disease. It is only by such means that we can meet the demands that will be made on entomology and give the science the place it deserves in relation to the welfare of man.

Two Hundred and Eighty-Third Meeting,

February 4, 1915.

The 283d regular meeting of the Society was entertained by Mr. C. L. Marlatt at the Sængerbund Hall, February 4, 1915. There were present: Messrs. Baker, Barber, Bishopp, Böving, Busck, Caudell, Champion, Cory, Craighead, Crawford, Cushman, DeGryse, Fink, Fisher, Gahan, Gill, Greene, Howard, Hutchinson, Hyslop, Isely, Knab, Kotinsky, McIndoo, McGregor, Marlatt, Middleton, Ransom, Rohwer, Rust, Sanford, Sasscer, Schwarz, Shannon, Siegler, Simanton, Snyder, Stiles, Townsend, Turner and Walton, members, and A. G. Ackerman, W. M. Davidson, R. J. Fiske, G. L. Garrison, E. W. Geyer, A. C. Johnson, W. V. King, F. L. McDonough, H. L. Nichols, H. K. Plank, and J. F. Turner, visitors.

Messrs. L. O. Jackson and D. E. Fink were elected to active membership.

The following papers were presented:

On the Reflex Bleeding of the Coccinellid Beetle, Epilachna borealis
Dr. N. E. McIndoo.[1]

An Asiatic Insect Pest in America via Europe...........August Busck.[1]

---

[1] Withdrawn from publication.

NOTES ON THE NESTING HABITS OF SOME SOLITARY WASPS.[1]

By J. B. Parker.

I. PSAMOPHILA VIOLACEIPENNIS (LEP.)[2]

In constructing their nests the wasps of this species dig down more or less vertically to the depth of about an inch and then at the bottom of the shaft construct a brood chamber usually at one side. This is somewhat circular in shape varying from three-fourths to one inch in diameter and is about half an inch in depth. In digging the nest the wasp loosens a quantity of sand with her mandibles and front feet, then gathers it up with her front legs and holds it firmly pressed back into her grasp by the use of her mandibles. With the load of sand thus firmly held she backs out of the excavation to a short distance from the entrance, drops her burden, steps forward over it and reënters the burrow for another load. She is thus continually popping in and out of her nest while it is in process of construction. While digging the sand loose within the burrow the wasp makes a low humming sound much like that which the mud-daubers make when constructing their nests, but by no means so loud. It requires about ten minutes for the wasp to dig her nest, which is not begun until after a caterpillar has been found and paralyzed.

When the nest is complete the wasp hurries away to bring her caterpillar, running over the sand instead of flying. She turns the caterpillar upon its back, seizes it by the thorax with her mandibles and walking astride it drags it to the nest. Whether she uses the second pair of legs to support the larva while transporting it I could not positively determine, but I am inclined to think she does. She leaves the caterpillar at the entrance to the nest, goes within, turns round, comes to the entrance and having seized the caterpillar with her mandibles she backs into the nest dragging her prey after her. The egg is placed transversely on the side of the caterpillar on one of the more anterior abdominal segments. After oviposition the wasp emerges from the nest and seals up the entrance, in doing which she digs a quantity of sand down into the opening and then rams it down with her head, repeating the performance until the opening is completely filled up. She then smooths over the surface above the entrance to the nest and flies away.

---

[1] Contribution from the Biological Laboratory of the Catholic University of America, No. 2.

[2] Specimens of this species and also of the two following were kindly identified by Mr. S. A. Rohwer.

Wasp No. 55 was observed running excitedly about over the sand with her abdomen arched and her wings flipping nervously in a manner that characterizes this species when seeking a place for a nest after having captured a caterpillar. She digged her nest about fifteen feet from the point where she had left her caterpillar lying in a clump of weeds. When the nest was complete and the wasp had gone to bring her caterpillar I placed my camera in position at the nest. The wasp quickly returned with her caterpillar and when she had taken it inside I reached down into the nest with a pair of forceps and pulled it out again. The wasp came out of the nest, stepped astride the caterpillar and bending her abdomen beneath the thorax inserted her sting on the ventral side. She then took the caterpillar inside as before and I promptly pulled it out again. This time she came out and with her mandibles seized the caterpillar, which was lying dorsal side up, and inserted her sting on the ventral side of the abdomen five successive times, each time in a different segment proceeding backward from the first or second. Once more she took the caterpillar inside the nest and again I pulled it out. This time, however, she held on to her prey and I pulled her out too.

She at once picked up her caterpillar and started off with it. After carrying it about aimlessly for a few minutes she placed it amid some grass near by and began the construction of a new nest some distance from the first one. It required just nine minutes for her to complete this nest. When she had it finished she returned to her caterpillar and took it inside the new nest.

In the meantime a number of parasitic flies had discovered the wasp and her prey. So far as my experience goes these flies do not pay any attention to the caterpillar so long as the wasp is not near it; but just as soon as she begins to work with it they seek to place their young upon it or to place them in the entrance to the nest. Since I wished to rear this wasp from the egg I was kept busy chasing the flies away. When the wasp entered the new nest I succeeded in driving all the flies away except one, which I was obliged to capture and which Dr. C. H. T. Townsend finds to be a new species belonging to the genus *Hilarella*.

As soon as the wasp had emerged and sealed up the nest I digged it up and after making a photograph of the egg in place on the caterpillar (fig. 2) I placed them in a glass-covered plaster breeding cell and buried the outfit to the depth of an inch below the surface of the sand in the garden. On the morning of July 22 the egg showed no evidence of hatching but on the following morning at the same hour the larval wasp was feeding on the caterpillar (fig. 3). In the case of this species the head of the larva develops at the end of the egg attached to the food provided by the mother wasp, just the reverse of what takes place in the

case of species of *Bembex* and *Bembidula*. As a result the larva makes a hole through the egg covering where this is attached to the caterpillar and then through the body wall of the caterpillar. It then thrusts its head through the opening and begins to feed on the internal parts of its victim. Thus the egg still remains in place till the growing larva ruptures it and even then it remains for a time as a collar about the larval wasp where it enters the caterpillar.

The young wasp does not change its position but remains with its anterior end thrust inside the caterpillar, which contracts in length as the feeding of the larval wasp proceeds. On the morning of the twenty-fifth the caterpillar had contracted considerably (fig. 4) and the wasp had greatly increased in size. On the twenty-sixth the caterpillar was entirely consumed—nothing remained but a few fragments of integument—and the fully developed larval wasp was spinning threads of silk over the sand in the cell (fig. 5). At six p.m. of the twenty-sixth the larval wasp was busily spinning its cocoon which was fully formed on the morning of the twenty-seventh (fig. 6).

The cell with its contents was placed in the sand in the garden and was not again disturbed till September 7, when it became necessary to transfer it to another place. To my surprise I found that the adult had emerged in the cell and unable to escape had perished there. The insect was badly decomposed and I should judge that it had been dead for at least a week.

Wasp No. 57 was observed July 27 busily engaged in digging a nest and when this had been digged to the depth of about one inch she suddenly backed out of the burrow and, if I may be permitted the use of a vulgar expression, "threw a fit." Apparently she had bitten into something that was exceedingly obnoxious to her. She rubbed her mouth parts violently with her front feet, twisted and contorted her body, bit into the stems and leaves of the weeds about her and displayed every manifestation of great distress. I got down quite close to her but could discover nothing on her body or appendages that could be the cause of her strange conduct. After some time she returned to her unfinished nest but no sooner had she thrust her head into the opening than another paroxysm ensued. This was less violent than the first. Again she returned to her nest but was affected as before just so soon as she reached the entrance and she then abandoned her task.

Curious to know what had been the source of her discomfort I digged down into the ground carefully following the opening made by the wasp. At the bottom of it I found a living but paralyzed caterpillar, the remains of a second one and the newly-formed cocoon of a wasp, but not of this species. Mingled in

the sand at the bottom of the excavation made by the wasp there was considerable excrement from the caterpillars but what it was that proved so objectionable to the wasp I could not determine.

On July 29 No. 58 was discovered constructing her nest, to complete which required a trifle more than ten minutes. In this case I pulled the caterpillar out of the nest no less than eight times. I hoped to induce the wasp to sting the caterpillar as No. 55 had done but she made no attempt to do so. On three occasions I pulled her out of the nest, clinging to the caterpillar with her mandibles, yet she never left the nest or made any effort to carry off her caterpillar. This contention over the caterpillar caused considerable sand to roll down into the nest so that on three different occasions the wasp had to lay the caterpillar aside and clean out the nest. A parasitic fly also joined the controversy and in spite of my efforts succeeded in placing one or more larvæ upon the caterpillar. None of these things discouraged the wasp; she was determined to put her caterpillar in that hole and I finally permitted her to do so. When the caterpillar was finally dragged within the nest the fly advanced to the opening, backed around and deposited two or more larvæ on the edge of it whence they wriggled off and dropped to the bottom of the nest.

The wasp remained within the nest not quite two minutes. After she had emerged and filled up the nest I captured her with my net and digged up the nest. Although less than ten minutes had elapsed from the deposition of the egg of the wasp to the removal of the caterpillar from the brood chamber yet one of the parasitic maggots was upon the egg, three more were clustered about it at the point of attachment to the caterpillar and a fifth was tucked in between the fourth and fifth abdominal segments on the ventral side. I removed these tiny larvæ but in doing so I must have injured the egg for it decomposed in the breeding cell.

No. 62 was discovered constructing a nest on August 1 and I used the same tactics with this wasp as with the preceding. Although I repeatedly pulled the caterpillar out of the nest and also pulled the wasp out too on several occasions she made no attempt to sting the caterpillar or to carry it away. On August 8 I discovered No. 64 filling up the entrance to a nest in which she had just placed a caterpillar. When this task was completed she began immediately to construct a new nest a few inches from the one just sealed up. When the nest was about one inch deep I approached quite close to the nest and the wasp became frightened and flew away, which fact leads me to believe that in this case the wasp had no caterpillar in readiness to place within this

The contents of the nest were placed in a breeding cell which was buried an inch below the surface of the sand in the garden. On the morning of August 2 the egg had not hatched but the caterpillars by spasmodic movements had changed their position in the cell and most of them had passed fæces. They responded readily when pricked with the point of the forceps. On the morning of the third the egg had hatched and the young larva was feeding upon the caterpillar to which the egg was attached, pursuing a course quite similar to that followed by *P. violaceipennis*. On the morning of the fifth the first caterpillar was almost completely consumed and the remaining ones responded but feebly to stimulation. On the sixth the larva was devouring the second caterpillar having its head and thoracic segments thrust within the body of the caterpillar. On the morning of the eighth it had devoured all the caterpillars and was beginning the construction of its cocoon, which was completed on the ninth.

The cocoon of this species is yellowish and semitransparent whereas that of *P. violaceipennis* is almost black and opaque. The adult of the latter emerged from the cocoon at the end of about one month; the former has gone through the winter in the cocoon. *Sphex* digs her nest and then searches for caterpillars with which to provision it; *Psamophila* captures her caterpillar and then digs a nest to put it in. Both bring the sand out of the nest holding it with the front legs and mandibles. *Psamophila* always backs away from the entrance of the nest with her load of sand which she drops and walks over in reëntering the nest. Not so with *Sphex;* after backing out of the nest with her load of sand she turns round and carries the sand forward for some distance from the nest and usually throws it in a neat pile. One individual, however, after backing out of the nest flew up into the air with each load of sand and scattered it in all directions.

Explanation of Plate.

Fig. 1, *Psamophila violaceipennis* (Lep.) with caterpillar at entrance to nest. × ½.

Fig. 2, caterpillar with egg of *P. violaceipennis* (Lep) in place. Natural size. Egg deposited July 20.

Fig. 3, larva from egg in Fig. 2, natural size. July 23.

Fig. 4, larva from egg in Fig. 2, natural size. July 25.

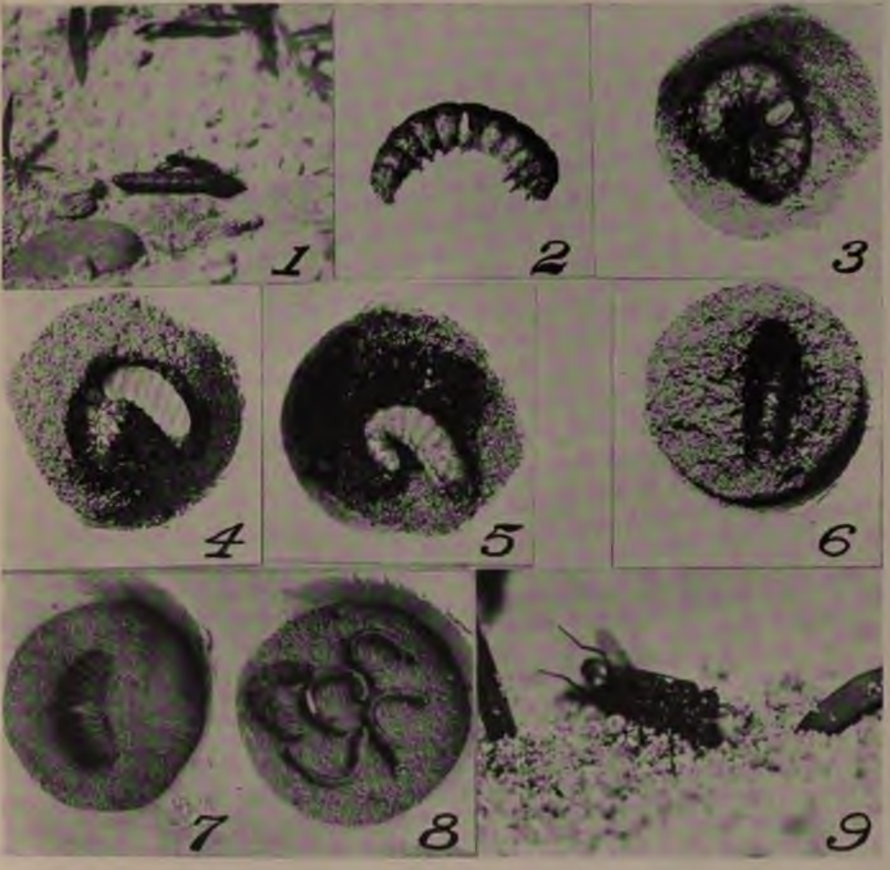
Fig. 5, larva from egg in Fig. 2, natural size. July 26.

Fig. 6, cocoon formed by larva in Fig. 5, natural size.

Fig. 7, egg of *P. violaceipennis* (Lep.) in place, natural size.

Fig. 8, content of nest of *Sphex urnaria* (Dahlb.) in breeding cell, natural size.

Fig. 9, *Oxybelus 4-notatus* Say at entrance of nest holding fly impaled


1
2
3
4
5
6
7
8
9

[redacted]

In discussing this paper Mr. Walton recounted having once observed a species of *Sphex* in New Mexico attempting to dig a hole in the bottom of a galvanized iron wash-tub.

ONE NEW GENUS AND TWO NEW SPECIES OF CERAMBYCIDÆ.

By W. S. Fisher, *Branch of Forest Insects, Bureau of Entomology.*

In working over the Cerambycidæ received from the field men of the branch of forest insects, Bureau of Entomology, during the past year, the following apparently new species were encountered. For one of these, a species from California, the larva of which bores in pine cones, it was found necessary to erect a new genus.

All types and specimens mentioned are deposited in the United States National Museum in Washington.

Hylotrupes juniperi n. sp.

Male: Elongate, rather robust, subdepressed, shining black. Antennæ three-fourths as long as the body. Thorax rounded on the sides, suddenly narrowed towards the base, which is slightly tubulate, the sides are densely and confluently punctured, the disc with three smooth longitudinal elevations, one median reaching from base to middle, and a crescent shaped one on each side forming a somewhat broken circle. Elytra each with two indistinct lines, surface very densely punctured, the punctures larger and less dense on the basal half, and becoming very small towards the apex, sparsely clothed with short black recumbent hairs. Femora not clavate. Fifth ventral segment truncate behind. Length 22 mm.; width 6 mm.

Female: Differs from the male in having the antennæ only two-fifths as long as the body, and the fifth ventral segment broadly rounded behind. Length 25 mm.; width 7 mm.

Habitat: Santa Catalina Mountains, Arizona. Elevation 4200 to 5000 feet. W. D. Edmonston and M. Chrisman, collectors.

Type and *allotype:* Cat. No. 19129 U. S. N. M.

Described from seven specimens. Two males and two females recorded under Bureau of Entomology Number Hopk. U. S. 12698. Material collected December 1, 1914, by W. D. Edmonston, from heartwood of green limb on dying Juniper (*Juniperus pachyphloca*). One male and two females recorded under Bureau of Entomology Number Hopk. U. S. 12259c, and reared from material collected by M. Chrisman on November 18, 1913, in the same locality from dying Juniper. Larva always makes burrows with the grain of the wood, half in the bark and half

in the sapwood, occasionally one in the sapwood. Larva when full grown makes burrow straight into the heartwood and pupates.

This species is very closely allied to *Hylotrupes amethystinus* Lec., but is distinguished from that species by having shining black elytra without any trace of the violet color.

Hylotrupes amethystinus Lec. has somewhat of a similar habit but as far as known, only attacks dying and felled *Libocedrus* and *Thuja*. The larva works under the bark, making broad winding excavations, eating the inner bark and outer sapwood, sometimes separating the bark from the wood, then enters the wood, sometimes burrowing to the heartwood where the burrows become longitudinal, pupating in either bark or wood, but usually in the heartwood.

Paratimia new genus.

Eyes moderately finely granulated, deeply emarginate, partly enveloping the base of the antennæ, but not as deeply emarginate as in *Atimia*. Head broad and short, the front perpendicular. Labrum transverse, ciliated with long hairs. Palpi unequal, the maxillary about twice as long as the labial last joint triangular. Antennæ slender, shorter than the body in both sexes, 11-jointed; second joint less than half as long as the thi d, which is a little shorter than the fourth, fifth joint longest; punctured and pubescent. Front coxæ rounded, narrowly separated by the prosternum, cavities angulated externally, completely closed behind; middle coxæ separated by the mesosternum about twice the distance which separates the front coxæ, cavities slightly angulated externally, completely closed by the sterna. Mesosternum concave between the coxæ, emarginate behind. Metasternum deeply emarginate behind. Legs short, femora slightly clavate, front tibiæ with one, middle and posterior ones with two small spurs, hind tarsi with first joint equal to the two following united.

Type: Paratimia conicola n. sp.

This new genus belongs to Leconte and Horn's tribe Atimiini but differs from the genus *Atimia* by having the front coxæ narrowly separated by the prosternum, the cavities angulated externally, eyes not quite as deeply emarginate and the last joint of the maxillary palpi being triangular. In general form it resembles a Lamiine but the front tibiæ are without the oblique grooves.

Paratimia conicola n. sp.

Male: Elongate, slender, subcylindrical. Thorax somewhat cordiform, not wider than long, front angles rounded, sides rounded just before the middle, then obliquely narrowed towards the base, surface fusco-piceus, coarsely and thickly punctured, and rather densely clothed with long prostrated reddish-brown hairs, those on the posterior half and underside whitish. Elytra a little wider than the thorax, two and one-half times as long as wide, sides nearly parallel, slightly narrowed towards the tips

which are separately rounded, surface brown, sparsely, rather finely punctured, sparsely clothed with long prostrated reddish-brown hairs intermixed with long erect ones of the same color, and with a very narrow sutural stripe of dense prostrated whitish hairs. Scutellum subquadrate, rounded behind, surface densely punctured and densely clothed with long prostrated hairs. Underside fusco-piceus, surface densely punctured, clothed with long prostrated whitish hairs. Femora, tibiæ and tarsi brown, sparsely clothed with semi-erect hairs. Fifth ventral segment about as long as the fourth, broadly emarginate behind. Length 10 mm.; width 3 mm.

Female: Differs from the male in having the fifth ventral segment longer than the fourth and rounded behind. Length 12 mm.; width 3 mm.

Habitat: Monumental Mines, California. Elevation 3600 feet. P. D. Sergent, collector.

Type and *allotype:* Cat. No. 19130 U. S. N. M.

Described from five specimens, four males and one female, recorded under Bureau of Entomology Number Hopk. U. S. 10856d. Reared by Mr. J. M. Miller from old cones of *Pinus attentuata*, collected October 2, 1913, by P. D. Sergent.

This interesting species is somewhat suggestive of a narrow *Atimia confusa*. It differs from that species by its reddish-brown color, elytra with a narrow whitish sutural stripe and tips separately rounded, thorax not wider than long and being somewhat cordiform.

DESCRIPTIONS OF NEW NORTH AMERICAN MICROLEPIDOPTERA.

BY AUGUST BUSCK.

In one of my early papers (Journ. N. Y. Ent. Soc., vol. VIII, 1900, p. 234), I expressed the opinion, that in the then existing unsatisfactory state of our knowledge of American Microlepidoptera, it was of little value (or worse) to describe promiscuously new species from collected material; only when working up a group systematically did it seem to me excusable to describe species of which the biology was not known.

This attitude has influenced my production of descriptive work during the past years and I have described new species only as the demand for names from correspondents necessitated it, or when other considerations made it desirable or obligatory. There are for this reason hundreds of Micros as yet undescribed in the collection of the United States National Museum.

I still have a disinclination for new species of which we know nothing more than the type specimens, (and the present paper

contains mainly species, of which the life history is known), but our knowledge of the group has now so advanced, that such descriptions can be made with profit to science and I realize the obligation to make our North American fauna known so far as possible. I also fully realize the propriety and value of the Monroe Doctrine as applied to Entomology; it is an advantage to science that American insects should be worked up by Americans and that the types should be deposited in American Museums in order that it shall not be as necessary for future generations to go to Europe for information on American insects, as it has been for the present generation. If we do not do our own work, others will quite rightly do it and with that result.

In a letter lately received from my good friend and master Edward Meyrick of England, which I am permitted to quote, he writes: "As to the principle of describing such species (without biological notes) from North America, I describe all the material that I have in hand of a family, before publishing that family in the Genera Insectorum in order to make this work as complete as possible. If you have species in good series, describe them. I have thousands of undescribed species in hand and material coming in constantly from all parts of the world, therefore I don't want to do American species, if any one else will do them. But I want the North American species described; if you do not do it I will have to do it myself." I quote this not because an excuse is needed to describe our American Micros, but in order to give my indefatiguable learned co-worker due credit not only for his own enormous personal share in the progress of our knowledge of the world's Microlepidoptera, but also for his ever incitating influence on other workers, forcing us to keep step with him as far as we are able.

Memythrus perlucida n. sp.

Labial palpi bright yellow, shaded exteriorly with vivid red. Head reddish brown. Antennæ reddish brown. A narrow collar light yellow, bordered anteriorly with blue metallic scales. Thorax dark reddish brown, narrowly edged posteriorly with yellow. Forewings light reddish brown with the veins bluish black; extreme base of costa light yellow; cilia blackish brown. Hindwings glassy blue, entirely transparent, except a narrow edge before the cilia, which is reddish brown mixed with black; veins black, touched with red. Cilia backish brown. Abdomen reddish brown with a narrow light yellow annulation on the posterior edge of second joint and a broader yellow annulation on fourth joint. In the male the posterior joints become somewhat lighter, touched with yellow; a short double yellowish brush above the uncus, not projecting beyond the claspers. Legs red, tarsi shaded with yellow. Alar expanse: 28–32 mm.

Type: Cat. No. 19223, U. S. N. M.

Reared by Mr. Brunner from *Populus trichocapa.* The species is closely allied to the other *Populus* species, *M. dollii* Neumoegen, and *castaneum* Beutenmuller, but at once distinguished by the clear hindwings.

Psacaphora cambiella n. sp.

Second joint of labial palpi reddish golden; terminal joint black. Face, head and thorax shiny iridescent black. Antennæ black with silvery white tips. Forewings purplish-black with a large, central, light brick-red part, which occupies about half the wing area; within this red part are three small oval black spots edged with purplish silvery scales; one of these spots is on the middle of the fold, the other at the end of the cell and the third about the middle of the cell, touching the black costal edge of the wing; at apical fifth is a light yellow costal dash, continuing into the cilia and on the terminal edge is a purplish silvery longitudinal streak within the black border; cilia black. Hindwings and cilia purplish black. Abdomen black. Legs black with golden yellow inner sides and with a golden annulation on posterior first tarsal joint. Alar expanse: 13–14 mm.

Habitat: Evaro, Mont., J. Brunner, Coll.

Type: Cat. No. 19224, U. S. N. M.

Bred from cambium of *Salix.*

Close to *P. purpuriella* Busck, in coloration, but different in pattern.

Eucordylea gallicola n. sp.

Second joint of labial palpi white with three indistinct dark brown annulations; brush dirty white with dusky tip; terminal joint white with two clear cut black annulations. Antennæ thick, ochreous with black annulations. Face and head ochreous white, head sprinkled with fuscous. Thorax whitish fuscous. Forewings light fuscous with three black costal dashes, one near base, one on the middle and one at apical third; these black costal spots are exteriorly edged by thin, ill-defined white lines, which continue obliquely across the wing, the two outer ones meeting on termen just below apex; two longitudinal black streaks on the middle of the wing, one just before and one after the end of the cell; before and below the first of these is a small group of slightly raised, rust-red scales on the fold; cilia fuscous dusted with black. Hindwings light fuscous with ochreous fuscous cilia; in the male with a large expansible, bright yellow hair tuft at base. Legs ochreous white sharply barred with black; tarsi with black annulations. Alar expanse: 13 mm.

Habitat: Colorado Springs, Colo., S. A. Rohwer, Coll.

Type: Cat. No. 19225, U. S. N. M.

Bred from galls of the Sawfly, *Euura macgillivrayi* Rohwer, on *Salix.*

The species reminds much of the genus *Recurvaria* from which *Eucordylia* is a derivative.

Recurvaria alnifructella n. sp.

Second joint of labial palpi dark fuscous with apex white; terminal joint white with two broad black annulations, one near the base and one just before the tip. Face and head ochreous white. Antennæ light fuscous with narrow black annulations. Thorax ochreous white, slightly sprinkled with fuscous and with two minute black dots at the base of the hindwings. Forewings black with white dorsal edge; an indistinct white, outwardly curved costal streak at apical fourth and an opposite oblique dorsal white streak limit an apical area, which is slightly mottled with lighter scales; three small black tufts of raised scales on the border of the white dorsal part; cilia ochreous fuscous. Hindwings silvery fuscous, semitransparent; in the male with a long ochreous expansible hairpencil at base; cilia ochreous. Abdomen dark fuscous with light ochreous anal tuft and with an ochreous patch on the upper side of the first joints. Legs black with ochreous white annulations at the end of all the joints. Alar expanse; 12 mm.

Habitat: Falls Church, Va., Carl Heinrich, collector.
Type: Cat. No. 19226, U. S. N. M.

The larva feeds in the catkins of alder and hazel in the same fashion as *Eucosma walkerana* Kearfott, the larva of which is described by Packard in his "Forest Insects" p. 636, misidentified as *Gelechia coryliella* Chambers (*Menesta tortriciformella* Clemens).

The full grown larva of the present species is about 12 mm. long with a light brown head, dark brown thoracic shield and anal plate; small brown tubercles, arranged in a transverse row on each segment; body is white with a broad pink annulation in each joint; thoracic legs light brown; abdominal prolegs with a circlet of hooks, which is broken on each side, interiorly and exteriorly.

Gnorimoschema gibsoniella n. sp.

Labial palpi white dusted with blackish brown scales; an ill-defined blackish annulation on the middle of terminal joint. Face and head white speckled with blackish brown. Thorax white strongly dusted with blackish brown. Forewings with a bluish white ground color, so strongly suffused with brown and blackish scales, as to make it difficult to determine what is the ground color; each white scale has a dark band before the tip; three ill-defined brown spots, one on the middle of the cell, one obliquely below on the fold and one at the end of the cell; basal part and dorsal edge of the wing least suffused with dark scales so as to slightly outline the pattern found in the type of the genus; cilia white strongly dusted with black and brown. Hindwings light fuscous with still lighter cilia. Abdo-

men light fuscous sprinkled with black; basal joints above short scales, golden yellow. Legs whitish, heavily barred and dusted with blackish brown; tarsi blackish brown with indistinct narrow white annulations. Alar expanse: 22 mm.

Habitat: Aveme, Manitoba, N. Criddle, Coll.
Foodplant: *Solidago rigida.*
Type: Cat. No. 19227, U. S. N. M.
Cotypes in Ottawa Museum.

Very close to but quite distinct from the type of the genus. Named in honor of my friend Arthur Gibson, who states that the species makes a gall on *Solidago rigida* just above or close to the ground.

Gnorimoschema petrella n. sp.

Labial palpi white, dusted with light fuscous. Antennæ white with dark brown annulations. Face, head and thorax white, strongly dusted with fuscous. Forewings white, liberally and evenly dusted with brownish fuscous atoms and with three small, indistinct, black dots, one on the middle of the cell, one obliquely below on the fold and one at the end of the cell; cilia dusky white, dusted with fuscous. Hindwings dark fuscous with the cilia a shade lighter. Abdomen dark fuscous with whitish undersides. Legs with heavy dark brown barred exteriorly and with broad dark brown tarsal annulations. Alar expanse: 17 mm.

Habitat: Hampton, N. H.; May, S. A. Shaw, Coll.
Type: Cat No. 19228, U. S. N. M.

Dichomeris vacciniella n. sp.

Labial palpi with moderate, bluntly triangular tuft, brownish fuscous, speckled with white on top of the brush: terminal joint light brown, dusted with black and with extreme base white externally. Face light brown. Head dark fuscous. Thorax and patagia brown. Forewings dark brown, sparsely and irregularly dusted with black scales; three small, round, black dots, edged with white scales, one on the middle of the cell, one obliquely below and before it on the fold and one at the end of the cell; apical part of the wing strongly suffused with purplish black scales, the extreme apical and terminal edge black; cilia dark fuscous with light ochreous brown tips. Hindwings light fuscous, suffused with black on the outer costal part; cilia light gray. Abdomen light ochreous brown, dusted laterally with black. Legs light ochreous brown, suffused exteriorly with black and with blackish tarsal annulations. Alar expanse: 15–17 mm.

Habitat: Pemberton, N. J., H. D. Scammell, Coll.
Type: Cat. No. 19229, U. S. N. M.
A very distinct species, bred by Mr. Scammel from cranberry.

Symmoca novimundi n. sp.

Second joint of labial palpi dark bronzy brown with light ochreous inner sides and apex; terminal joint dark brown with the extreme tip ochreous. Face light ochreous. Head dark fuscous. Antennæ dark fuscous with apical third pale ochreous. Thorax dark fuscous with the tips of the patagia and two small posterior dots whitish ochreous. Forewings dark fuscous with a small ill-defined whitish ochreous spot below costa near base; with a concolorous, ill-defined, larger spot on the end of the cell touching costa and with a small whitish ochreous costal spot at the apical fourth, sometimes with an opposite small dorsal dot; cilia dark fuscous. Hindwings light fuscous with whitish fuscous cilia. Abdomen dark fuscous with light anal tuft. Legs dark fuscous with light ochreous annulations at the base of the joints. Alar expanse: 12–13 mm.

Habitat: Roxborough, Pa., September, F. Haimbach, Coll.; Montclair, N. J., August, W. D. Kearfott, Coll.

Type: Cat. No. 19230, U. S. N. M.

This is the first record of this interesting old world genus from America; the species is typical of the genus and very close to the European *S. quadripuncta* Haworth, but is smaller, with the markings more whitish, not yellow and with the palpi differently colored.

Ethmia zavalla n. sp.

Labial palpi white, second joint black exteriorly. Face and head white. Antennæ dark brown with white basal joint. Thorax white with one posterior and two lateral black dots; patagia white with black basal dash. Forewings white with extreme costal base black and with 10 black dots besides a marginal series of 13 black dots; three dots in a line from base of costa to basal third of dorsum; two others in a line at right angles with the first, to the first costal marginal dot; one dot in the middle of this angle on the cell, two at the end of the cell and one beyond the cell; the first dorsal and the first costal marginal spots are nearly opposite and are both elongated; cilia white with a black apical tuft. Hindwings whitish fuscous with white cilia; vein 8 free, not connected with the cell by a cross vein. Abdomen whitish fuscous. Anterior legs white, barred with black, tarsi annulated with black; posterior legs whitish with dusky tarsi. Alar expanse: 18 mm.

Habitat: Zavalla Co., Tex., April F. C. Pratt, Coll.

Type: Cat. No. 19231, U. S. N. M.

Allied to the following species, *E. prattiella* and to *E. coranella* Dyar, in size and ornamentation; different from the former in the fewer and larger black dots, from the latter by the absence of any longitudinal streaks; from both in the coloration of the palpi.

Ethmia prattiella n. sp.

Labial palpi pure white, terminal joint unusually short. Face and head white. Antennæ dark brown with white basal joint. Thorax white with two minute anterior black dots and with two lateral dots; patagia white with a small basal black dot. Forewings white with 16 small black dots besides a marginal series of black dots; one dot at extreme base of the wing; five dots in a longitudinal row on the upper half of the wing from base to beyond the first costal dot; two are on the fold, one below the fold, three within the cell, three beyond the cell; cilia white. Hindwings whitish fuscous with white cilia. Abdomen light fuscous. Legs whitish with dusky tarsi. Alar expanse: 17 mm.

Habitat: Zavalla Co., Tex., April, F. C. Pratt, collector.
Type: Cat. No. 19232, U. S. N. M.

Blastobasis eriobotryæ n. sp.

Labial palpi dark purplish fuscous with the inner side and extreme apex light ochreous. Face light ochreous. Top of head dark fuscous. Antennæ dark fuscous with light ochreous basal joint; second joint in the male enlarged with a deeply excavated notch. Thorax dark brownish fuscous. Patagia and extreme base of the forewings lighter, mixed with ochreous; rest of the forewing dark purplish fuscous, darkest towards the contrasting light base; a small round black dot on the middle of the cell and two similar black dots at the end of the cell; cilia light ochreous fuscous. Hindwings golden fuscous with cilia concolorous. Abdomen dark ochreous fuscous with lighter undersides and anal tuft. Legs light ochreous fuscous with heavy broad black bars on the exterior side and with the tarsi annulated with black. Alar expanse: 14 mm.

Habitat: Miami, Fla., E. R. Sasscer, Coll.
Type: Cat. No. 19233, U. S. N. M.
Bred from dry "mummy" fruit of Loquat, *Eriobotrya japonica*, hanging on the trees; moths issued early in July.

Sparganothis albicaudana n. sp.

Labial palpi light reddish ochreous. Face straw colored, apparently depressed, due to the projecting bright ochreous scales of the head. Antennæ ochreous with white upper side. Thorax and forewing bright yellow, faintly reticulated with slightly raised lines of golden coppery scales; the female has a blackish brown oval spot on the middle of dorsal edge, faintly connected with a small costal spot at basal third by a light coppery, angulated line; from the middle of costa runs a more distinct, outwardly curved, coppery line across the wing to the dorsal edge just before tornus; extreme terminal edge light coppery; cilia yellow. The male has a small, dark reddish brown costal fold, covering only a sixth of the costa, and the dorsal and costal spots are much lighter colored than in the female

light bluish brown. Hindwings ochreous white. Abdomen white. Legs ochreous white without dark annulations. Alar expanse: ♀ 20 mm.; ♂ 17 mm.

Habitat: Notch, Pa.
Type: Cat. No. 19205, U. S. N. M.
Bred by the writer from leaftying larvæ on maple together with nearly allied, *Sparganothis pettitana* Robinson, which occurred in much larger proportions.

Spargonothis ferreana n. sp.

Labial palpi reddish ochreous, shaded exteriorly with reddish brown. Head light ochreous. Thorax reddish brown, with the posterior tip and the tips of the patagia yellow. Forewings rusty brown with light ochreous markings, made up of small oval spots, separated by veins of the ground color; the basal third of the wing is mottled in this pattern; another aggregation of ochreous spots occupy a large semicircle, resting on the middle of the costal edge; a third area of somewhat further separated ochreous spots occupies the apical fourth of the wing; only a broad dorsal blotch at apical third of dorsum with two oblique branches to costa show the unmottled brown ground color; cilia yellow. Hindwings silvery white with a ochreous tinge. Abdomen whitish ochreous. Legs whitish, shaded exteriorly with brown. Alar expanse: 21 mm.

Habitat: Ilion, N. Y., H. McElhose, Coll.
Type: Cat. No. 19234, U. S. N. M.
A striking species allied *S. reticulana* Clemens.

Tortrix (Cacœcia) lambertiana n. sp.

Labial palpi light reddish ochreous; second joint ascending, terminal joint short, porrected. Face, head and thorax light golden brown. Antennæ light brown with whitish annulations. Forewings light golden brown with silvery ochreous markings, which are edged with darker reddish brown, as follows: an indistinct, strongly angulated fascia from middle of costa to tornus, the lower half of which is nearly perpendicular and broken up into half a dozen spots by thin longitudinal crosslines of the ground color; perpendicular series of similar spots just before apex; all of these markings are in other fresh, bred specimens more or less obliterated by the ground color; cilia silvery white. Hindwings whitish ochreous with white cilia. Abdomen and legs dull ochreous. Alar expanse: 19 to 22 mm.

Habitat: Oakland, Oreg., P. I. Sergent, Coll.
Foodplant: *Pinus lambertiana.*
Type: Cat. No. 19235, U. S. N. M.
Closely allied to *Tortrix negundana* Dyar and allies, for which Meyrick retains the genus *Cacœcia* on the single character: ascending palpi, in difference from his conception of *Tortrix*, which

is restricted by him to the forms with porrected palpi; I am at present unable to maintain more than one genus.

Abrenthia new genus.

Labial palpi long, curved, smooth; second joint rather short; terminal joint twice as long as second; pointed, not flattened. Maxillary palpi rudimentary. Tongue well developed, curled. Antennæ half as long as the forewings, thick, smooth, with short joints and very short pubescence. Face, head and thorax smooth. Forewings elongate ovate, apex blunt, termen and dorsum evenly rounded, costa nearly straight to apical fourth; cilia short; 12 veins, all separate; 11 from near base; 2 from before the cell; 3 to 10 from end of the cell; internal vein from between 10–11 to between 7–8; 1 b. furcate at base; 1 c. present, but obliterated towards base. Hindwings as broad as the forewings, trapezoidal, costa and dorsum nearly straight, parallel; apex blunt, termen straight; tornus rounded; 8 veins; 8 free; 3 and 4 connate; 5, 6 and 7 somewhat approximate at base; cilia short. . Posterior tibiæ smooth.

Type: *A. cuprea* Busck.

The genus is near to *Millieria* Ragenot, *Maclotica* Meyrick and *Glyphipteryx* Hübner, different from all of these in the smooth, nearly sickleshaped, pointed palpi with the terminal joint much longer than the second.

Millieria Ragenot has incorrectly been sunk as a synonym of *Porpe* (*Choreutis* Authors) by Meyrick; the latter genus must be restricted to the species with veins 3 and 4 coincident in the hindwings.

Abrenthia cuprea n. sp.

Labial palpi light golden purple. Antennæ purplish black. Thorax, patagia and extreme base of forewings dark bronze with strong metallic golden reflections. Forewings dark purplish blue with numerous thin, equidistant, longitudinal, whitish violaceous lines from base to apex; apical edge strongly metallic violaceous; cilia dark brown. Hindwings blackish brown with whitish cilia. Abdomen dark purplish brown with silvery underside. Legs dark brown with white tarsal annulations. Alar expanse: 11 mm.

Habitat: Roxboro, Pa., June, F. Haimbach, collector; Falls Church, Va., July, Carl Heinrich, collector.

Type: Cat. No. 19239, U. S. N. M.

A gorgeously colored little moth, unlike any North American species, reminding one of the South American genus *Maclotica* to which it is allied.

Coleophora acamtopappi n. sp.

Labial palpi light ochreous, whitish on the inner sides; second joint with small pointed tuft. Antennæ light ochreous without basal scale tuft.

Face and head whitish ochreous. Thorax light ochreous with two longitudinal white streaks; patagia ochreous with white edges. Forewings light golden yellow with three longitudinal white streaks; one broadly covering the costal edge, one through the middle of the wing, broad to the end of the cell, thence attenuated to apex and one narrow white streak along the dorsal edge, reaching only to the middle of the wing; cilia whitish ochreous. Hindwings dusky ochreous with whitish cilia. Abdomen ochreous fuscous with dark yellow underside and anal tuft. Alar expanse: 18 mm.

Habitat: Los Angeles, Cal., October, A. Koebele, Coll.
Foodplant: *Acamtopappus sphærocephalus.*
Type: Cat. No. 19240, U. S. N. M.

Closely allied to the other California species, *C. quadristrigella*, Busck, *C. entoloma* Busck and *C. accordella* Wlsm., but easily distinguished by the pattern.

Coleophora suædæ n. sp.

Labial palpi white, touched with yellow on the outer side of second joint, which has a small, pointed, projecting tuft. Antennæ slightly thickened towards base, but without tuft on first joint, light ochreous with narrow white annulations. Face, head and thorax light ochreous. Forewings light ochreous with ill-defined broad longitudinal white streaks, heavily dusted with dark brown; one such brown dotted streak lies below the costal edge on vein 12; four shorter parallel lines start at the edge of the cell and run to costa, the last one to apex; one line runs along the lower edge of the cell and one on the fold; none of the costal streaks reach quite to the costal edge, which is unmottled and brighter yellowish than the rest of the wing; cilia whitish ochreous. Hindwings and cilia light ochreous. Abdomen light fuscous with ochreous underside and anal tuft. Legs light ochreous; posterior tibiae with a longitudinal yellow line exteriorly. Alar expanse: 18 mm.

Habitat: Los Angeles, Cal., November, A. Koebele, Coll.
Foodplant: *Suæda suffrudecens.*
Type: Cat. No. 19241, U. S. N. M.

The case is cylindrical, but rather bulging, rough, made of the foodplant, light ochreous; mouth slightly deflected and cut off at 45 degrees; the posterior tip pressed together from three sides; length 10 mm.

This species is next to but distinct from *Coleophora acutipennella* Wlsm; it is very different from the other American *Coleophora* on *Suæda*, *C. suædicola* Cockerell, which is a much smaller white, black speckled species with a dark brown cigar-shaped case.

Coleophora manitoba n. sp.

Labial palpi white. Face, head and thorax white. Antennæ thickened and serrated with scales on basal half, white with dark brown annulations.

Forewings white sparsely dusted with black scales towards apex and with a small, deep black dot within the dorsal margin at apical third; cilia white. Hindwings silvery fuscous with dusky white cilia. Abdomen whitish. Legs white; posterior tibiæ dark brown exteriorly. Alar expanse: 13–14 mm.

Habitat: Aweme, Manitoba, N. Criddle, collector.

Type: Cat. No. 19242, U. S. N. M.

Cotype in the Ottawa Museum.

The species was bred from cases found on grass. The case is dark brown, made of silk with numerous small pieces of gravel incorporated; it is cylindrical with the head opening cut off nearly laterally to the case, without any neck; anal opening pressed together from three sides.

Marmara pomonella n. sp.

Second joint of labial palpi blackish brown with apex white; terminal joint white with an anterior black spot. Maxillary palpi whitish with black tips. Face, head and thorax in the specimen before me are badly rubbed, but apparently normally blackish brown. Forewings bluish black, shiny, with a large silvery white costal spot on the middle wing, another similar costal spot at apical third, and a silvery white fascia just before apex; cilia blackish with apical part silvery white. Hindwings dark fuscous with lighter fuscous cilia. Abdomen bluish black with silvery underside and anal tuft. Legs black with broad, silvery white annulations. Alar expanse: 8 mm.

Habitat: Corvallis, Oregon, H. F. Wilson, Coll.

Type: Cat. No. 19243, U. N. S. M.

Bred from larva mining just under skin of apple. The work and the larva of this species have long been known and have repeatedly been sent in for determination; the mine is figured in Bull. 10, new series, Division of Entomology, U. S. Dept. of Agriculture, 1898, page 88, fig. 19.

Marmara serotinella n. sp.

Labial palpi silvery white; second joint with a blackish brown apical annulation. Maxillary palpi dark fuscous. Face and front parts of the head silvery white; top of the head dark brown. Thorax blackish brown. Forewings blackish brown with silvery white markings; broad, triangular, white fascia at basal third is broadest on the dorsal edge and attenuated on the costal edge; oblique white fascia beyond the middle of the wing is thinner on the middle than at the edges of the wing; at apical fourth is a small white costal spot and opposite a similar dorsal spot; beyond this is a small white dash or a few white dots in the costal cilia; cilia dark fuscous. Hindwings dark brownish fuscous. Abdomen backish brown above, underside and anal tuft silvery. Legs silvery white with dark brown annulations. Alar expanse: 6 mm.

Habitat: Falls Church, Va., C. Heinrich, collector.
Type: Cat. No. 19244, U. S. N. M.
Foodplant: *Prunus serotina.*

Exceedingly close to the type of the genus *Marmara salictella* Clem., but with less white ornamentation of the apical parts of the wing. The deeply serrated, typical larva makes long mines just under the epidermis of the branches of wild cherry characteristic of the genus.

Argyresthia castaneella n. sp.

Labial palpi golden white. Face and head pure white. Antennæ golden with brown annulations. Thorax white; base of patagia golden. Forewings white with a broad, bright, golden, longitudinal streak along costal edge, gradually widening from the middle of the wing into the darker, golden brown apical part, which is slightly reticulated with white; at the end of the cell is a darker golden brown spot, adjoining the dark costal part of the wing; on the middle of the dorsal edge is a similar dark spot; cilia white; forewings with veins 7-8 stalked. Hindwings dark fuscous with white cilia. Abdomen dark brown above, silvery white on the undersides with golden anal tuft. Legs silvery. Alar expanse: 10 mm.

Habitat: Falls Church, Va., May, C. Heinrich, collector; Hampton, N. H., June, S. A. Shaw, collector.
Type: Cat. No. 19245, U. S. N. M.

Very close to *Argyresthia subreticulata* Wlsm., but darker in color and differing by the dark dorsal spot in the otherwise pure white dorsal part of the wing.

Mr. Heinrich has bred this species from the bark of chestnuts, infested with *Sesia castaneæ* Busck.

Argyresthia franciscella n. sp.

Labial palpi, face and head yellowish white. Antennæ with white basal joint, with dark brown annulations. Thorax white. Forewings pearly white, dusted with light brown; an outwardly oblique blackish brown streak from basal third of dorsum is faintly continued to costal edge; a similar, parallel, brown streak from just beyond the middle of dorsum may likewise be faintly traced to apical third of costa, where it meets an ill-defined transverse fascia from apical fourth of dorsum; apical part of the wing strongly suffused with bronzy brown; cilia white with a few irregular, black dashes at base. Hindwings light fuscous with whitish cilia. Abdomen silvery white. Legs white with dark brown tarsal annulations. Alar expanse: 10 mm.

Habitat: San Francisco, Cal., May, E. O. Essig, Coll.
Type: Cat. No. 19246, U. S. N. M.

Easily distinguished from all the American brown marked species of the genus by the two dorsal dark streaks. Received from Mr. E. O. Essig with the label "in tips of Cypress."

Zelleria haimbachi n. sp.

Labial palpi, face and head pure white. Antennæ white with ill-defined, light. brown annulations. Thorax white edged posteriorly and laterally with golden yellow; patagia golden yellow. Forewings light, golden yellow with a broad, central, longitudinal, white streak from base to apex; outer half of costal edge, apical part of the wing and cilia slightly dusted with black; cilia black. Hindwings silvery, whitish fuscous; cilia white. Abdomen silvery white mixed with light yellow, anal tuft pure white. Legs silvery white. Alar expanse: 12 mm.

Habitat: Wenonah, N. J., F. Haimbach, collector.
Type: Cat. No. 19247, U. S. N. M.

Bred from short needle pine by Mr. Haimbach after whom this striking little species is named. The species pupated June 31, and the imago issued July 17. The species reminds one in coloration and pattern of *Cerostoma* (*Abebœa*) *gerdanella* Busck.

Bucculatrix ilecella n. sp.

Face silvery white. Tuft and head white mixed with ochreous fuscous. Antennæ white with dark brown annulations; eyecaps white. Thorax and forewings white, suffused with light ochreous brown scales; two very ill-defined faint crosslines of blackish brown scales, one from the middle and one from apical third of costa obliquely outwards across the wing; three or four small groups of blackish brown scales on the fold; cilia white with dark brown basal line. Hindwings silvery fuscous with whitish cilia. Abdomen silvery fuscous above with silvery white underside. Legs silvery white, indistinctly barred with blackish brown exteriorly. Alar expanse: 4 mm.

Habitat: Victoria, Tex., July, W. D. Hunter, Coll.
Foodplant: *Ilex* species.
Type: Cat. No. 19248, U. S. N. M.

Probably the smallest species of this genus on record; it belongs in the *pomifoliella* group. Bred by Mr. Hunter from holly; the cocoons are pure white strongly longitudinally ribbed; typical of the genus, length 5 mm.

Incurvaria gillettella n. sp.

Labial and maxillary palpi dark brown, the former with bristles at the end of the second joint. Head rusty red. Antennæ blackish brown with white annulations. Thorax dark brown. Forewings dark brown with three silvery white, angulated fasciæ, the first from basal third of costa inwardly inclined and partly obliterated to near the base of dorsum; the second inwardly inclined from the middle of costa, sharply angulated on the cell and thence outwardly bent to apical third of dorsum; the third from apical third of costa, strongly inwardly curved, ending on vein 3, without attaining the dorsal edge. Cilia brown with white tips. Hind-

wings loosely scaled, semitranslucent, light brown with concolorous cilia. Abdomen and legs uniformly dark brown. Alar expanse: 25 mm.

Habitat: Silverton, Colorado, C. P. Gillette, Coll.

Type: Cat. No. 19249, U. S. N. M.

This is the largest described American species of this genus, nearest to *I. oregonella* Walsingham, but easily distinguished by the pattern.

Incurvaria itoniella n. sp.

Labial palpi yellowish white with a few black bristles; maxillary purplish black. Antennæ bronzy, blackish brown. Face and head light reddish yellow with a few scattered black hairs. Thorax and forewings unicolored dark greenish brown with strong bronzy reflections, and in some lights golden; cilia bronzy brown. Hindwings dark purple with scattered golden scales around the edges; cilia purplish brown. Abdomen and legs bronzy brown; posterior tibiæ with long silky whitish hairs above. Alar expanse: 11 mm.

Habitat: Kaslo, Brit. Columbia, J. W. Cockle, Coll.

Type: Cat. No. 19250, U. S. N. M.

Very similar in size and general habitus to our eastern *Euclemensia acerifoliella* Clemens, but differing generically and in the lighter, more greenish color; it is also somewhat more narrow winged.

The genus *Incurvaria* has been separated by Mr. Meyrick (Hand Book 1895) on the antennal ciliation in the male, and some of the European species as *I. capitella*, have on this ground been placed in the genus *Tinea*. This is another striking case, where the use of secondary sexual characters has caused curious mistakes in generic classifications; *I. capitella* and its allies are aculeates and hence do not even belong to the same family as the genus *Tinea;* the genera *Tinea* and *Incurvaria* may be best separated by the presence or absence of wing aculeation.

Incurvaria cyanella n. sp.

Labial palpi golden yellow. Antennæ black. Face and head light reddish yellow. Thorax dark bronzy brown. Forewings dark greenish and bluish bronzy brown overlaid with scattered metallic golden scales; cilia dark brown. Hindwings dark purplish brown with lighter brown cilia. Abdomen blackish brown. Legs blackish brown. Alar expanse: 10 mm.

Habitat: Oak Station, Pa., F. Marloff, Coll.

Type: Cat. No. 19287, U. S. N. M.

Very close to the foregoing species *I. itoniella* Busck, but smaller, darker, more bluish in color and at once distinguished by the metallic golden sealing on the forewings.

Incurvaria cockerelli n. sp.

Second joint of labial palpi light yellow, terminal joint black. Tongue black. Antennæ black with silvery white tips. Face and head reddish ochreous. Thorax dark metallic green. Forewings dark greenish bronze, with strong metallic golden reflection; at apical third is a large, transverse, oval, light yellow spot, touching the dorsal edge and reaching nearly across the cell; underside deep blue, sprinkled with golden scales; cilia blackish brown. Hindwings deep purplish blue, with base of costal edge silvery fuscous and with cilia dark metallic brown. Abdomen dark bluish brown. Legs dark bronzy brown. Alar expanse: 11 mm.

Habitat: Long Peak and Peacefull Valley, Colorado, Prof. T. D. A. Cockerell, collector.

Type: Cat. No. 19288, U. S. N. M.

Named in honor of the collector, who continually adds interesting finds to the National Museum.

It is close to the following species, *I. sedella,* but larger, with darker head and with yellow, oval spot at apical third supplanting the transverse white fascia.

Incurvaria sedella n. sp.

Labial palpi yellow with black terminal joint and black setæ. Antennæ bronzy black with white tips. Face and head yellowish white. Thorax dark bronzy brown. Forewings dark bronzy brown with a white transverse fascia at apical third; cilia bronze. Hindwings dark purple with basal half of costa silvery white; cilia dark golden purple. Abdomen dark purplish brown. Legs silvery, shaded with dark purple. Alar expanse: 9 mm.

Habitat: Boulder, Colo., T. D. A. Cockerell, collector.

Type: Cat. No. 19289, U. S. N. M.

Taken by Prof. Cockerell on *Sedum.*

Prodoxus barberella n. sp.

Labial palpi brownish fuscous, touched with white. Maxillary palpi blackish fuscous. Antennæ blackish brown, dotted on the upper side of basal half with white and with white basal joint; ciliation in the male 1. Face, head and thorax white. Forewings white with blackish brown longitudinal markings as follows: costal third with short irregular longitudinal dashes, which towards apex form three more defined short lines, running obliquely to the costal edge; a large, longitudinal brown dash on the middle of the fold, a small one on the cell and a large one beyond the end of the cell; an approximate semicircular dorsal spot at apical third, an ill-defined series of marginal dark brown spots before the cilia; cilia white, dusky at apex and at tornus. Hindwings semitransparent with scant, hairlike, dark fuscous scales; cilia whitish fuscous. Abdomen blackish brown with whitish anal tuft. Legs dusky white. Alar expanse: 14–17 mm.

Habitat: Ray, Ariz., 4400 feet altitude, H. S. Barber, collector
Foodplant: *Agave palmeri.*
Type: Cat. No. 19290, U. S. N. M.

I am pleased to dedicate this interesting and pretty species to Mr. Barber who, on January 4, 1914, cut a tall dry flower stalk of the *Agave* in Arizona and brought it to Washington, where more than a hundred moths issued from it about the middle of March. The larvæ are glassy white with light brown head and dark brown mouth parts; they are, as is typical of the genus, entirely apodal, without any trace of thoracic legs or abdominal prolegs; length 12–14 mm.; before pupation they bore out to the surface of the stalk, leaving only a thin silk lined circular lid, which is pushed out by the pupa at emergence; the pupal shell is thin and flimsy and remains protruding from the exit hole.

The genus *Prodoxus* Riley has been incorrectly sunk as a synonym of *Tegeticula* Zeller (= *Pronuba* Riley) in the Biologia. The two genera are abundantly distinct in all stages; the larva of *Tegeticula* has thoracic legs, that of *Prodoxus* is apodal; the pupa of the former is strongly and characteristically spined, while that of *Prodoxus* is smooth, and the remarkably developed "Maxillary tentacle" in *Tegeticula* is represented in *Prodoxus* only by a slight protuberance.

RHABDOBLATTA BRUNNEONIGRA, A NEW COCKROACH FROM CHINA.

By A. N. Caudell, *Bureau of Entomology.*

Among a few miscellaneous Orthoptera from China recently received for determination from N. Gist Gee of Soochow was a large roach which, according to Shelford's keys, belongs to the genus *Rhabdoblatta*. The species is apparently a new one and the following description is therefore presented.

Rhabdoblatta brunneonigra n. sp.

A brownish black roach nearly one and one-half inches in length exhibiting the following characters: Head projecting somewhat from beneath the pronotum; eyes large and separated by a distance as great as twice the greatest width of the basal segment of the antennæ; ocelli large and as widely separated as the eyes; antennæ shorter than the body, the basal segment large and over twice as long as broad, the second slightly smaller and scarcely longer than broad, the succeeding ones gradually diminishing in diameter, those of the basal third or so transverse, beyond growing more elongate, those towards the apex slightly more than twice as long as broad. Pronotum about twice as broad as the head, the widest part slightly in advance of the middle, anteriorly very broadly rounded and posteriorly obtuse angulate, the disk with a pair of somewhat obscure shallow depressions on each side of the middle. Legs moderately stout, all the

femora armed beneath on both margins with three or four moderately stout spines; tarsi with distinct pulvilli, the basal segment, especially of the middle and hind legs, long and distinctly armed beneath, except on the apical fourth or fifth which is occupied by the pulvillus, with a double row of short sharp spinules; claws with moderately large arolia between them. Wings black, or nearly so, in the anterior half, the anal area very moderately fuliginous towards the outer margins, basally still less so; posterior ulnar vein many branched, some of the branches ending in the dividing vein; apically the wing is slightly undulate, being somewhat prolonged in the marginal area (fig. 1). Elytra far surpassing the tip of the abdomen, about as broad as the pronotum and about four times as long as broad, the sides subparallel and the apex subtruncate, being somewhat undulate as in the wing.

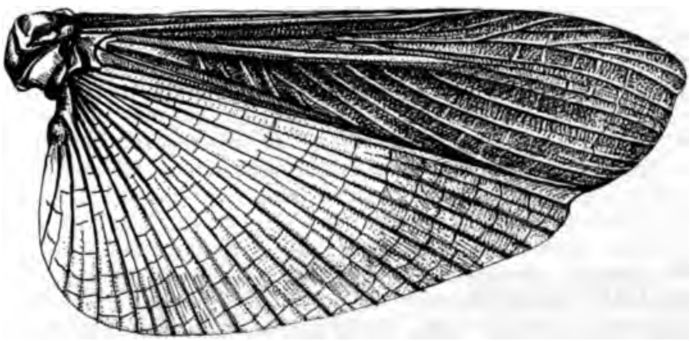


Fig. 1. Rhabdoblatta brunneonigra Caudell.

Abdomen with the subgenital plate entire and bearing a pair of short movable styles; supraanal plate mesially depressed longitudinally and apically notched; cerci moderately slender and surpassing the supraanal plate by more than one-half of their own length.

General color brownish black; head and pronotum black, the eyes and the ocelli light brown and the antennal scrobæ, the mesial portion of the clypeus and some of the palpal segments marked more or less with the same color. Legs black with the spines a little lighter and the tarsi yellowish. Abdomen blackish above, beneath black for the entire length mesially, laterally yellowish, the yellowish margins and black central stripe of subequal widths; cerci and styles and the whole of the subgenital plate blackish.

Length: pronotum, 6.5 mm.; elytra, 29 mm.; cerci, 3 mm.; width: pronotum at widest point, 7.5 mm.; elytra at middle, 8 mm.

Described from one female from Kuling Kiangsi, China, N. Gist Gee, collector.

Type: Cat. No. 19125 U. S. National Museum.

ON THE GENUS EXORISTOIDES COQ. (TACHINIDÆ).

By W. R. Walton, *Bureau of Entomology, Cereal and Forage Insect Investigations.*

In following the work of the late Mr. D. W. Coquillett in the Muscoidean flies, the fact soon becomes obvious to the student that he sometimes brought together under one generic name (often by means of artificial characters) several rather widely related forms. This indeed was his usual method of procedure where the material before him was meager and yet seemed of sufficient interest to merit description. I am personally in favor of this system because it obviates the danger of making unnecessary generic names and still permits the recording of the specific descriptions. These can usually be made broad enough to include any and all characters which may subsequently prove to be of generic importance.

The genus *Exoristoides*[1] Coq. is evidently of this character. Mr. Coquillett[2] has designated the species *johnsoni* as the genotype. Additional material of the other two recorded species has recently fallen into my hands. Specimens of *Exoristoides harringtoni*[3] Coq. collected at Plummer's Island, Md., by Dr. A. K. Fisher, and at Dead Run, Fairfax County, Va., by R. C. Shannon, show structural characters which demonstrate beyond a doubt that the species is not congeneric with the genotype.

The other species, namely, *slossonæ* Coq. seems doubtfully congeneric with *johnsoni* Coq., the shape of the third antennal joint is quite dissimilar, and the scanty setulæ of the first vein are sometimes missing in the male. When this occurs the species will run to *Exorista* in Mr. Coquillett's table. Whether or not the missing setulæ have ever existed is difficult to decide. But perhaps the species would better remain where it is for the present. The genus is characterized by Mr. Coquillett as follows:

"First vein partly bristly, frontal bristles descending below base of antennæ, vibrissæ on a level with front edge of oral margin, antennæ reaching lowest fourth of face, eyes distinctly hairy, head at vibrissæ distinctly shorter than at base of antennæ, sides of face bare, apical cell open, facial ridges bristly on lower fourth, third vein bristly more than half way to small crossvein." The following notes are made from the genotype: Apical cell ending in costa distinctly before wing tip, fifth vein destitute of setulæ

---

[1] Rev. N. Am. Tach., p. 31.

[2] Type species of the N. A. Diptera, p. 544.

[3] This species was originally designated as the type of a new genus in the present paper as read February 4th, but was anticipated under the generic name *Homalactia* Townsend in Proc. Biol. Soc. Wash., Vol. XXVIII, pp. 19 24, February 12.

beyond second basal cell, bend of fourth vein destitute of stump or wrinkle, fourth vein beyond the bend curved gently inward. The two species may be easily separated as follows:

First Vein with at most two or three widely separated setulæ on outer third, third joint of antenna black, gently concave on its front edge, arista shorter than third antennal joints (fig. 1–2), = *slossonæ* Coq.

First Vein bearing setulæ to the number of six or seven on its intermediate third only, third antennal joint in part yellow, gently convex on its front edge, arista longer than third antennal joint (figs. 3–4), = *johnsoni* Coq.

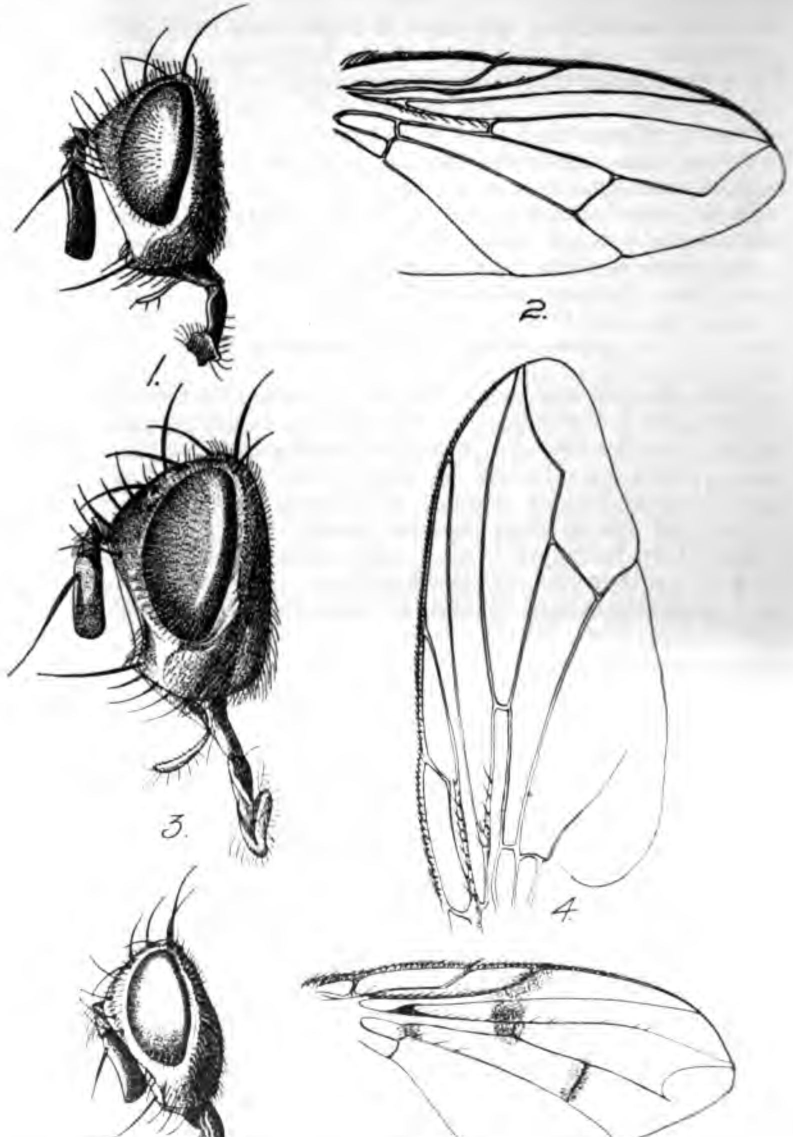
Homalactia Townsend.

Palpi present well developed (fig. 5); first vein thickly setulate on its outer two-thirds, third vein setulate to a point considerably beyond small crossvein, fifth vein bearing three or more bristles just beyond second basal cell (fig. 6); lower half of face on sides bare, frontal bristles strongly developed, descending to base of arista, the lowest ones curving upward (fig. 5); proboscis not longer than height of head, fleshy. Apical cell ending close to wing tip, either open or closed and short petiolate. Fourth vein bent violently inward beyond the bend which bears a short stump directly in line with the fourth vein before its bend. Third antennal joint subdentate on its lowest front corner. Ocellar bristles directed forward, head shorter at vibrissæ than at base of antennæ. Vibrissæ on oral margin; eyes thinly hairy; front tarsi of female distinctly dilated, hind tibiæ not ciliate.

Type: Exoristoides harringtoni Coq. (figs. 5–6).

In describing this unusually marked species[1] Mr. Coquillett had before him but one specimen which is at present in a poor state of preservation. It differs from the specimens before me in having the apical cell closed and petiolate. The original description of the type makes no mention of the presence of a row of several bristles on the fifth longitudinal vein near its base. The occurrence of these is a rare thing in the Tachinidæ. They are found in *Polychætoneura elyii* Walton, and *Chætoplagia atripennis* Coq. and in a few other genera. The latter fact was overlooked in my description of *Polychætoneura* but in no-wise affects its standing as *Chætoplagia* belongs to that group possessing a row of macrochætæ on the face.

[1] Proc. U. S. Natl. Mus., Vol. XXV, p. 110.


1.
2.
3.
4.
5
6
W.R.W.

EXPLANATION OF PLATE.

Fig. 1, *Exoristoides slossonæ* Coq.................................head
Fig. 2, *Exoristoides slossonæ* Coq.................................wing
Fig. 3, *Exoristoides johnsoni* Coq.................................head
Fig. 4, *Exoristoides johnsoni* Coq.................................wing
Fig. 5, *Homalactia harringtoni* Coq...............................head
Fig. 6, *Homalactia harringtoni* Coq...............................wing

---

MOSQUITOES ATTACKING A FROG.

BY R. C. SHANNON, *Bureau of Entomology.*

A bullfrog (*Rana catesbeiana*), was seen sitting upon a log in a swamp at Dead Run, Fairfax County, Virginia, May 23, 1915, and upon it were a number of mosquitoes which arose from his back in a small swarm when he moved at my approach. The mosquitoes returned as soon as the frog became quiet again and resumed their feeding. When first seen the frog appeared to be unaware of the blood-suckers. When nearer approach was attempted the frog jumped into the water leaving the mosquitoes behind. Four specimens were captured and these have been determined by Mr. Knab as *Culex territans* Walk.; their abdomens were distended and the imbibed blood showed through the integument.

Mr. Knab informs me that there has been considerable doubt that *Culex territans* sucks blood. In spite of the fact that the species is very common in the eastern United States and breeds everywhere in smaller collections of water, no definite feeding record of it has been made, and it has been doubted if it would attack man or other warm-blooded animals. The present observation suggests that the species may confine its attacks to frogs and perhaps other cold-blooded animals.

A NEW SPECIES OF THE GENUS SECODELLA.

By J. C. Crawford.

This interesting species was first reared by Mr. Marcovitch in 1913 when he secured a very few specimens, but during 1914 it occurred in large numbers and a fine series was sent to me for study.

The species of this genus are very striking in appearance due to the lines of cilia on the fore wing and also to the row of bristles on the under side of the wing just back of the marginal vein.

Secodella argyresthiæ n. sp.

Female: Length 3 mm. Deep purple with some greenish tints; face with a deep cross furrow in front of anterior ocellus; head with crowded fine punctures, those above cross furrow coarser; antennæ brown, scape and pedicel purple; first and second joints of funicle subequal in length, each about one and one-half times as long as the pedicel; third and fourth joints successively shorter, together about as long as the club; mesonotum with fine thimble-like punctures, those on the scutellum finer than on scutum; propodeum very short, with a median carina; wings hyaline, upper surface of fore wings with six rows of cilia, three from stigmal knob as follows: one running apicad and close to anterior margin of wing, touching anterior margin before apex of wing, one curving caudad and running to apical margin, one running diagonally across wing basad to rear of wing and forming the border of the non-ciliated basal area; two lines run from base of ciliated area to apical margin, one close to posterior border, the other some distance anteriad of the former; the sixth originating within the ciliated area and running to apical margin; lower surface of fore wings with a row of five or six long curved bristles close to marginal vein at about its middle; legs purple, anterior tarsi brown, middle and hind tarsi, except apices, whitish; abdomen elongate.

Male: Length 1.8 mm. Similar to the female.

Habitat: Ithaca, N. Y.

Host: *Argyresthia alternatella.*

Type: Cat. No. 19408, U. S. N. M.

Described from a series reared by Mr. S. Marcovitch, from whom it was received.

Actual date of publication, June 8, 1915.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVII 1915 No. 3

TWO HUNDRED AND EIGHTY-FOURTH MEETING, MARCH 4, 1915.

The 284th regular meeting of the Society was entertained by the married members at the Saengerbund Hall, March 4, 1915. There were present Messrs. Abbott, Baker, Barber, Cory, Crawford, Cushman, DeGryse, Ely, Gahan, Gill, Greene, Heinrich, Hunter, Hutchinson, Isely, Jackson, Knab, Kotinsky, McIndoo, Middleton, Popenoe, Quaintance, Rohwer, Rust, Sasscer, Schwarz, Shannon, Snyder, Townsend, Turner, Walton, Webb and Wood, members, and Messrs. J. M. Aldrich, F. W. Dry, Jacob Goldberg, H. G. Ingerson, A. C. Johnson and H. K. Plank, visitors.

Mr. E. L. Divens was elected a Corresponding Member.

The following papers were presented:

THE BERMUDA GRASS ODONASPIS.

BY JACOB KOTINSKY,

Branch of Forest Insects, Bureau of Entomology.

Shortly after arrival in Honolulu in 1904 I discovered this insect more or less heavily infesting Bermuda grass (*Cynodon dactylon*) or "Manienie," as it is called there. Its habitat is mostly underground but invariably on the stem, never on roots. Once discovered, it is quite conspicuous by its beautiful, chalky whiteness, and oyster shape. It is always lodged under the scale-like bracts at the node.

Bermuda grass is apparently the only grass in Hawaii suitable, and is practically the only grass used, for lawn purposes. It is also well adapted for grazing purposes, especially on the low lands, hence the insect depredation is of some economic value. It is fortunate, therefore, that this scale is kept in check, to a degree at least, by a parasite. This is a beautiful, tiny, metallic green chalcidoid new to science both generically and specifically, according to the late Dr. Ashmead.

The writer was certain at the time that the coccid was undescribed, and, though he had drawn up a description and prepared drawings, failed to publish it, in the contemplation of publishing a paper covering all the coccids of Hawaii, including descriptions of all species found there new to science. As often happens, this work was delayed until 1909. Meantime, the late Mr. Craw had occasion to refer to the insect in writing to Mr. Ehrhorn, who was then in California, and called it by my MS. name, and the latter incorporated it in one of his reports. In this wise the manuscript name got into print, but *sine* description. Meantime also, Mr. Bremner published in the Canadian Entomologist for 1908 a description of *Odonaspis graminis*, from grass in California, which was so similar to the species in question, that the author took them to be identical, especially since he received the assurance of Mr. Ehrhorn to that effect. It was therefore referred to by that name in Proc. Haw. Ent. Soc. II, 127. I have since been advised by Mr. Marlatt that the species is distinct. Mr. Sasscer, of the U. S. Bureau of Entomology was kind to supply me with the slide he prepared from material originally sent to the National collection of Coccidæ. These were used for the following description.

Odonaspis ruthae, n.sp.

Female scale: Oyster shaped or mytiliform when full grown, about 1.75 mm. long, 0.75 mm. wide; chalk white; *exuviæ* at elevated end, partly or entirely covered with white waxy dust which rubs off easily, straw colored. Ventral scale well developed, with dorsal completely enclosing and sealing insect. *Male scale:* Same shape, but only about half the size of female. *Adult female:* In balsam (fig. 1), irregularly circular; hyaline, except gland-bearing margin of last 7 or 8 segments, including caudal half of pygidium, and mouth parts, all of which are more or less heavily chitinized. Diameter about 0.63 mm. *Pygidium* (fig. 2) viewed from head toward median lobes looks like a very regular inverted outline of a bell, the median lobes corresponding to the tongue, 0.36 mm. long over all, 0.315 mm. wide at tips (of "bell"). Segmental sutures distinct half way cephalad from caudal margin. *Lobes:* 2 pairs, but slightly denser than chitinized margin, not very conspicuous. Median, narrow, parallel,

rounded caudad, but apparently united, actually separated, like rest of pygidial posterior margin enveloped in a filmy membrane, intervening space at base roundly emarginate, project but 10 μ caudad of main marginal line. Second pair but slight, triangular elevations on marginal line. *Incisions:* None.

Paraphyses: Fairly distinct at sutures of two last segments, somewhat clavate cephalad. *Plates:* None. *Spines:* One each side of median lobes, on dorsum and ventrum; also one dorsal at anterior end of segmental margin. *Anal opening:* Rather small, evidently posteriorly directed, circular, central within chitinized longitudinally oval area, about one-fourth length from base of pygidium. *Paragenitals:* 3 groups, the laterals elongate, apparently anterior and posterior group united. Anterior 12–17 glands; lateral 29–33. *Dorsal pores:* Very numerous, especially on more chitinized portions of abdominal segments, arranged in more or less regular rows longitudinally. *Basal thickenings:* None. *Ventral thickenings:* None. Second stage described by author in paper above referred to.

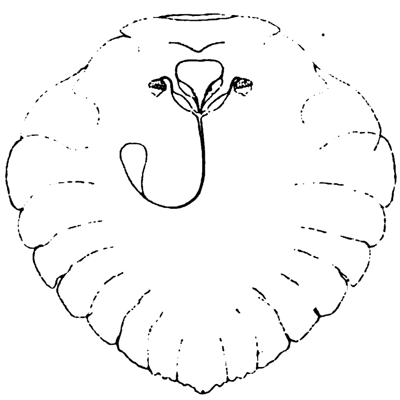


Fig. 1. Odonaspis ruthae. Contour of female.

Fig. 2. Odonaspis ruthae. Pygidium of female.

Type: Material and slide in U. S. coccid collection No. 14089, from which this description is made.

This species is easily mistaken for *O. graminis*, but is quite distinct from it when slide preparations are compared. Among the more conspicuous differences are: the greater width of base of pygidium in our species; the dorsal pores and intersegmental sutures on the abdomen are much more distinct. Also, the median lobes of *ruthæ*, as indicated, are more separated, and the species is perceptibly smaller and more hyaline than *graminis*. Moreover, our species bears paragenital glands which do not occur in the other.

A specimen (slide) in the Bureau collection from New Orleans, La., on Bermuda grass (T. C. Barber) is in its pygidial characters absolutely identical with *ruthæ*, except that the entire body is considerably longer, being oval in outline (0.93 x 0.64 mm.). Paragenital pores in lateral groups more numerous. They may be specimens of this species grown under more favorable conditions.

The drawings were kindly made for me under my criticism by Miss E. Hart from Mr. Sasscer's photograph and slide.

A NEW AND INTERESTING GENUS OF NORTH AMERICAN TACHINIDÆ.

By W. R. Walton,

Bureau of Entomology, Cereal and Forage Insect Investigations.

Our knowledge of the muscoid parasites of grasshoppers in North America is gradually being enlarged. Some of the genera now known to have this habit are as follows:[1] *Sarcophaga*, *Ocyptera*, *Hilarella*, *Trichopoda*, *Heteropterina*, *Acemyia*, and I now add another, constituting a new and unique genus and species. The former I take great pleasure in proposing in honor of the late D. W. Coquillett whose valuable preliminary work in the superfamily Muscoidea is recognized by nearly all students.

Coquillettina, new genus.

Related to *Acemyia* Desv. Palpi small and slender, first vein bare, sides of face on lower half bare, proboscis shorter than height of head, eyes bare, lower front corner of third antennal joint bearing a projection, in the male pointing forward (fig. 1 a) in the female, downward and forward (fig. 3b) the lower edge distinctly notched. Eyes bare, front in

[1] I view with grave doubt the authenticity of the recorded rearing of *[illegible]*, Will. from *Dissosteira carolina*, by Prof. Lugger in 1874 as published by Mr. Coquillett.

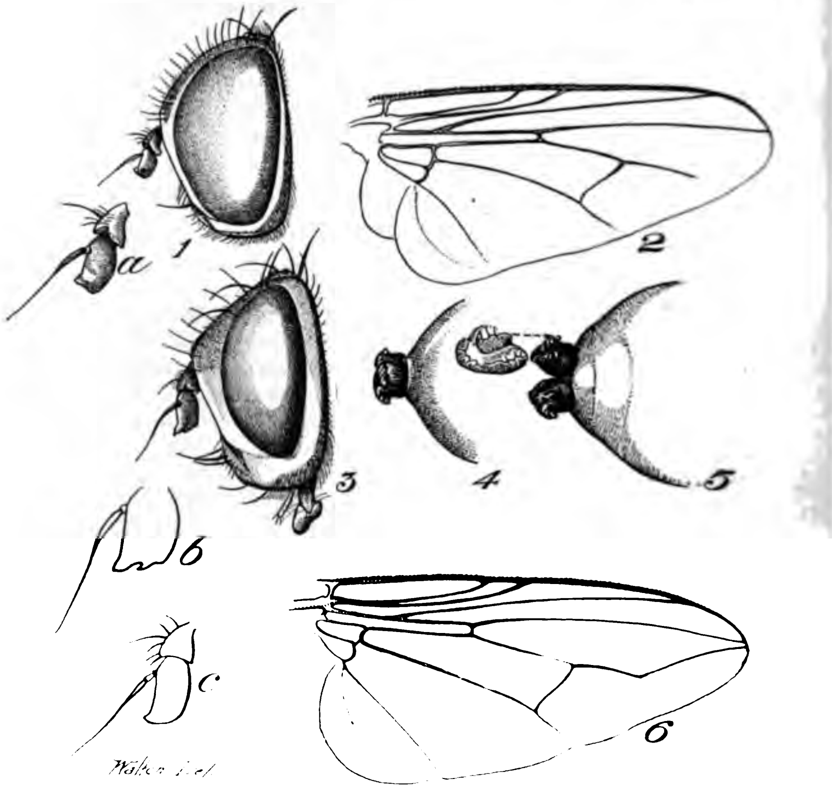
male very narrow, about one-third width of either eye, in female wider than either eye. Antennæ scarcely reaching to lower half of face, vibrissæ rather weak, situated at least the length of second antennal joint above front edge of oral margin. Facial ridges almost bare, only a few weak bristles on their lower fourth. Cheeks in male almost linear, in female not more than one-fourth eye height in width. Frontal bristles not descending below base of antennæ. Ocellar bristles directed forward. Wings (fig. 2) whitish hyaline, costal spine obsolete, fourth longitudinal vein absent beyond the bend, third vein ending in costa close to tip of wing, anal vein weak, not reaching posterior margin. Puparium with anal stigmata (fig. 4 and 5) projecting, knobbed, closely approximated.

Coquillettina plankii, new species.

Type, the following new species.

Male. Rather compact, entirely grayish pollinose, nowhere shining, length 6 mm. Head hemispherical, slightly wider than thorax, sides of front grayish pollinose, clothed with rather long fine erect hairs, orbits narrowly edged with silvery. Antennæ yellow, the outer side of third antennal joint brownish, same slightly longer than second joint (fig. 1–a). Arista brown, naked second joint not longer than broad. Genæ, posterior orbits and facial depression silvery pollinose. Frontal vitta brown, very narrow at vertex, widening at base of antennæ. All the macrochætæ of the head weak. Beard short and grayish in color proboscis and palpi yellow. Orbital bristles absent. Thorax and scutellum concolorous dark grayish pollinose. Four distinct vittæ, the inner pair narrow and becoming obsolete near middle of dorsum, the outer pair reduced to triangular spots before the suture and short narrow streaks posterior thereto. Postsutural dorso-central bristles three, sternopleurals two, which are scarcely distinguishable from the long pilose hairs surrounding them. Pleuræ cinereous pollinose. Abdomen ovate, cinereous pollinose, a dark circular spot surrounding each marginal abdominal macrochæta. All segments bearing marginals, no discal on any segment. Abdominal vestiture consisting of scattered coarse black recumbent hairs. Wings milky hyaline, veins yellowish. Legs, including coxæ, yellowish, the femora brownish on sides. Pulvilli whitish front ones as long as last tarsal joint, claws not greatly elongated.

Female. Similar to male except as noted in the generic description and as follows, two pairs or orbital bristles present, frontal vitta occupying nearly one-third width of front. Antennæ entirely yellow, third joint, about one and one-half as long as second. Pollen of superior orbit and front with a yellow tinge, posterior orbit about twice as wide as in male. Postvertical bristles well developed, nearly as long as ocellars. Abdomen missing in the unique specimen as are the legs with the exception of one front femur which is clear yellow in color. Pleuræ whitish pollinose, sternopleural plate almost naked, excepting the two sternopleural macrochætæ.



EXPLANATION OF PLATE.

Fig. 1. *Coquillettina plankii*, head of male; *a*, enlarged veiw of antenna.
Fig. 2. Wing of same.
Fig. 3. Head of female; *b*, enlarged outline of right antenna from inner side.
Figs. 4 and 5. Lateral and dorsal views of pupal, anal stigmata with detail showing irregular outline of slits.
Fig. 6. Wing of *Acemyia tibialis* Coq.; *c*, outline of antenna of same.

Described from one female and two male specimens, the former fragmentary. All reared (from a cage in which undetermined grasshoppers were confined) Aug. 8, 1914 at Pasadena, N. J., by H. K. Plank of the U. S. Bureau of Entomology, in whose honor this interesting fly is named. Type, a male, deposited in the U. S. National Museum, Washington, D. C. This species bears superficially a close resemblance to *Acemyia tibialis* Coq. but is obviously generically distinct. Nature apparently takes delight in demonstrating how closely she can approximate two entirely distinct forms.

REVISION OF MYIOPHASIA.

By Charles H. T. Townsend.

In 1891 the writer erected the two new genera *Phasioclista*, genotype *P. metallica* new species; and *Ennyomma*, genotype *E. clistoides* new species (Trans. Am. Ent. Soc. XVIII, 369 and 371). In the same year Brauer & von Bergenstamm erected the new genus *Myiophasia*, genotype *Tachina ænea* Wiedemann (1830) from Montevideo, S. A. (Musc. Schiz. II, 362). The latter authors misidentified Georgia specimens of *Phasioclista metallica* with *Tachina ænea*, as indicated by Wiedemann's description,[1] and gave therefrom what they considered to be a redescription of the latter species. They explicitly state in their text that they had Wiedemann's badly preserved holotype of *Tachina ænea* before them at the time, from which it results that their *ænea* is a composite species; and, if this be not sufficient for the genotype fixation of *Myiophasia*, their use of the words "Type Montevideo" after the name *ænea* would seem to fix that species as the genotype despite the misidentification principle involved.[2]

In 1892 the writer described three new species of this group under the names *Lœwia globosa* (Ent. News III, 129), *Lœwia ruficornis*, *Lœwia nigrifrons* (Can. Ent. XXIV, 77), and *Clista americana* (l.c. 78), the last two being in all probability male and female of one species.

---

[1] The combination (in male) of deeply golden-rayed wings, yellow wing-veins and deep golden tegulæ, with strongly oblique crossveins, described by Wiedemann for *Tachina ænea*, does not occur in any of the North American forms seen by the writer.

[2] In order to place the genotype of *Myiophasia* beyond dispute, the composite species *Myiophasia ænea* Brauer & von Bergenstamm, 1891, Denkschr. Kaiserl. Akad. Wiss., Math.-Nat. Cl. LVIII (Musc. Schiz., II) 362, is hereby restricted to the species *Tachina ænea* Wiedemann, 1830, Aussereurop. Zweifl. Ins., II. 298, as represented by the Montevideo (South America) holotype.—C. H. T. T.

In 1897 the above five North American species, including the two new genera, were lumped by Coquillett under the name *Myiophasia ænea* Wiedemann, and not one of them belongs to that species (Rev. Tach. 50).

In 1905 Aldrich endorsed Coquillett's disposition of these five species, stating that he had examined the types and verified the synonymy in each case, and commented on what he considered the description of the same species "several times under different genera, or in the same genus," intimating the folly of attempting to draw descriptions too closely in these flies and pointing out this as the worst example of the kind committed by the present writer (Cat. Dipt. N. A. 420, 421 and 427). Such is the history in brief relating to the celebrated case of *Myiophasia ænea.*

The writer implied in 1908 that the last word had not yet been said on this case, stating that several well-marked forms have been confused here, and described a sixth new North American species of the group under the name *Myiophasia setigera* (Tax. Musc. Flies 56). He has now completed a study of the external adult characters of all the forms of the *Myiophasia* group represented by material in the U. S. National Museum collection, comprising 164 specimens. The results of this study are the selection of *Lœwia globosa* and *Lœwia nigrifrons* to serve as genotypes of the two new genera *Eulœwia* and *Ennyommopsis* respectively, and the validation of both *Phasioclista* and *Ennyomma* and their genotypes. While the genus *Myiophasia* can not be positively determined in the absence of material from Montevideo, it appears probable that the above species *setigera* from western North America may belong to it, and the species is provisionally referred thereto.

The following synoptic table will serve to separate the five genera and various subgenera, species and subspecies of this group, which forms a natural tribe on the borderline between the Dexiinæ and Megaprosopinæ. Every one of the 164 specimens in the U. S. National Museum collection can be quite readily determined by it with the exercise of a little care.

SYNOPSIS OF NORTH AMERICAN MYIOPHASIINI.

1. Apical cell ending in or very close to exact wingtip, normally closed; axis of hind crossvein strongly oblique to that of apical crossvein, in middle between small crossvein and bend of fourth vein or nearer to former; eyes of male normally thickly pubescent, those of female very thinly and inconspicuously so but the hairs always visible . . . 2

Apical cell ending conspicuously before exact wingtip, usually open; axis of hind crossvein nearly or quite parallel with that of apical crossvein 4

2. Abdomen much longer than broad, both sexes with a median marginal pair of macrochætæ on second segment, usually marginal row of evenly-placed macrochætæ on third segment, all macrochætæ decidedly strong; cheeks nearly one-half eye-height in both sexes; front prominent in both sexes, the parafacials broad and usually polished in male; eyes of male usually not contiguous, the frontalia normally visible between them; female front at vertex little less than one eye; wings of male normally strongly tinged throughout with deep fuscous-golden, those of female for most part clear; apical cell normally ending in exact wingtip, never petiolate, practically always closed in male, often narrowly open in female; insertion of hind crossvein nearly in middle in both sexes; claws of male normally very elongate and lower border of head usually bulged behind eyes; parafacial hairs outside marginal row usually vestigal in female, well developed in male; male with soft blue-black coat over parafrontals, mesoscutum, scutellum and first two abdominal segments, leaving rest of abdomen and broad median vitta of first and second segments metallic dark green, female without such coat....ENNYOMMOPSIS (new genus) *nigrifrons*

Abdomen scarcely longer than broad, female without median marginal pair of macrochætæ on second segment; third segment never with an evenly-placed row but only with a median and two lateral marginal pairs, all macrochætæ decidedly delicate; cheeks hardly one-third eye-height in both sexes; parafacials never polished and always comparatively narrow, the front normally not prominent but very sloping in both sexes; eyes of male normally contiguous, the frontalia not showing between them; front of female at vertex much less than one eye; wings nearly clear in both sexes, apical cell normally ending slightly before exact tip and often short-petiolate especially in male; lower border of head not bulged behind eyes, parafacial hairs usually marked in both sexes.. 3

3. Insertion of hind crossvein in male normally conspicuously nearer to small crossvein than to bend of fourth vein, in female usually more nearly in middle; parafacials comparatively very narrow; claws of both sexes nearly equal; soft blue-black coat of thorax showing on first two abdominal segments in male, not in female. EULŒWIA (new genus) *globosa* (Subgenus A)

Insertion of hind crossvein nearly in middle in both sexes; front in both sexes sloping but subprominent, the parafacials considerably broader than in preceding; claws of male rather elongate; soft blue-black coat of thorax scarcely showing any tinge on first two abdominal segments in either sex. *Eulœwia madrensis* new species (Subgenus B)

4. Eyes of both sexes absolutely bare of hairs; apical cell well open; eyes not contiguous in male, the frontalia visible between them; female front at vertex conspicuously less than one-third head-width......11

Eyes of male normally thickly pubescent, those of female less thickly so, but hairs always easily visible in both sexes; eyes practically contiguous in male, usually obliterating the frontalia at point of contact; female front at vertex fully one-third head-width or considerably more.......... 5

5. Abdomen pollinose in whole or part.......... 6
   Abdomen without pollen, wholly glabrous; both sexes normally with median marginal pair of macrochætæ on second segment.......... 8

6. Female without and male with median marginal pair of macrochætæ on second segment.......... 7
   Both sexes with such pair; parafacial hair rows well developed in both sexes....*Ennyomma robusta* subsp. *madera* new subspecies (Subg. A)

7. Apical cell normally closed; front in both sexes very prominent, antennæ inserted high; parafacial hairs normally vestigal in female; frontalia, antennæ and palpi dark.
   Ennyomma robusta neomexicana new name for *Myiophasia robusta* Walton, 1914, Proc. U. S. N. M. XLVIII. 179 (nec Coquillett, holotype, 1897, Rev. Tach. 51)—(Subg. A)
   Apical cell narrowly open; front of male not prominent; parafacial hair rows well developed; frontalia, antennæ and palpi light reddish or yellowish.......... *Ennyomma robusta* (Subg. A)

8. Front of male not prominent; head not bulged behind below eyes; marginal row of macrochætæ of third abdominal segment closely placed.......... 9
   Front of male prominent, the parafacials much widened; head bulged behind below eyes; marginal row of third segment not closely placed.......... 10

9. Insertion of hind crossvein nearer bend of fourth in both sexes; palpi and third antennal joint black or blackish.......... *Ennyomma clistoides* (Subg. A)
   Insertion of hind crossvein in middle in male, nearer bend in female; antennæ wholly rufous.......... *Ennyomma ruficornis* (Subg. B)

10. Parafacials, parafrontals and mesoscutum cinereous pollinose; median marginal pair of macrochætæ of second segment weak in male, varying in female from absent through weak to well developed; palpi black or blackish.
   Ennyomma clistoides subsp. *mesensis* new name for *Myiophasia setigera* Walton, 1914, Proc. U. S. N. M. XLVIII. 179 (nec Townsend, 1908, Tax. Musc. Flies Smiths. Misc. Coll. LI. 56
   Parafacials parafrontals and mesoscutum silvery-white pollinose; median marginal pair of macrochætæ of second segment strong in

both sexes; palpi rufous; front usually still more prominent than in preceding....*Ennyomma clistoides* subsp. *sierricola* new subspecies

11. No strong median marginal macrochætæ on second segment in either sex; hind crossvein of male in middle between small crossvein and bend of fourth vein, that of female a little nearer bend; hairs of parafacials outside marginal row normally vestigial, and marginal row weakly developed; third and fourth abdominal segments with marginal row of equally strong macrochætæ. *Phasioclista metallica*

    Strong median marginal pair on second segment in both sexes; hind crossvein much nearer bend of fourth in both sexes............12

12. Hairs of parafacials normally well developed, especially marginal row; marginal row of macrochætæ of third segment often not of equal strength, due to partial development of extra bristles; face, third antennal joint and palpi except tips black.......*Myiophasia setigera*

    Bristles and hairs less developed on parafacials and abdomen; antennæ, palpi and face wholly rufous. *Myiophasia setigera* subsp. *oregonensis* new subspecies

It is highly important to separate and recognize the above forms by reason of their value in geographic ecology. Those who lump them ignore their true significance and are blind to the import of ecologic and evolutional principles. The impress of the environment is upon each of them. When, in the course of time, a series of some thousands of specimens shall have been secured, representing all the forms of this group occurring in the principal ecologic centers of North America, the variation in the environmental stamp exhibited by the series will furnish us a most instructive lesson in muscoid ecology. As large series as possible should be gathered from every variety of habitat. Such plastic forms as the present, by virtue of the very conditions which make them so difficult to classify, are of far greater biologic importance than those which show little change over wide ranges of territory or throughout continental areas. It therefore goes without saying that we should miss the kernel of biological investigation, and secure only the chaff, were we to yield to the easier alternative of lumping them.

The following is the distribution of the 164 specimens studied, to which are added published records of material not in the U. S. National Museum collection, with character of biogeographic environment for each form:

ENVIRONMENTAL AND GEOGRAPHICAL DISTRIBUTION.

Myiophasia setigera—2 males, Beulah (8,000 ft.) and Pecos, New Mexico (Cockerell); 2 females, Rociada and Santa Fe,

New Mexico (Cockerell)—Transition of the southern Rocky Mt. region, invading the edge of the boreal and also the edge of the arid upper austral; holotype from Beulah, which is in the edge of the boreal.

Myiophasia setigera oregonensis—2 females, Corvallis, Oregon (Cordley) and Ormsby County, Nevada (Baker)—Transition of the Sierra Nevada region on the borders of the boreal; holotype from Corvallis, Oregon.

Type: Cat. No. 19574 U. S. N. M.

Phasioclista metallica—2 females, Georgia (Morrison); 3 males and 1 female, South Carolina (Conradi and Townsend); 1 male and 1 female, Maryland (Shannon)—Described from 2 males, Carlinville, Ills., and Inverness, Florida—2 specimens recorded as reared by Forbes in Illinois (Psyche, VI. 467)—Humid lower austral, reaching Chesapeake Beach, Md., and middle austral of Illinois on north, and invading the semitropical of Florida on south; distinctively lower austral.

Ennyomma clistoides—2 males, Onaga, Kansas and Denton, Texas (C. R. Jones)—Described from 1 male, Carlinville, Ills.—Humid middle to lower austral prairie region. The Kansas and Texas localities are on the 96th and 97th meridians respectively. Also a male recorded from Brookings, So. Dakota, in same region (Can. Ent. XXIV. 78).

Ennyomma clistoides mesensis—29 males and 9 females, Koehler, New Mexico (Walton)—Arid upper austral.

Type: Cat. No. 19615 U. S. N. M. (Male).

Ennyomma clistoides sierricola—9 males and 17 females, Las Visayas and San Pedro de Madera in the Sierra Madre of Chihuahua, 7,000 to 8,000 ft. (Townsend)—Transition of the northern Sierra Madre region.

Type: Cat. No. 19617 U. S. N. M. (Male).

Ennyomma robusta—1 male, Los Angeles County, California (Koebele)—Humid patches in arid semitropical lowlands of the Pacific coast.

Ennyomma robusta madera—2 females, San Pedro de Madera in the Sierra Madre of Chihuahua, 8,000 ft. (Townsend) and Mexico City (O. W. Barrett)—Transition of the northern to central Sierra Madre region.

Type: Cat. No. 19668 U. S. N. M. (S. Pedro de Madera).

Ennyomma robusta neomexicana—4 males and 5 females, Koehler, New Mexico (Walton); 1 male and 1 female, Mexico City (O. W. Barrett)—Arid upper austral plains and high plateau south.

Type: Cat. No. 19669 U. S. N. M. (Male, Koehler N. M.).

Ennyomma ruficornis—4 males and 1 female, White Mts., N. H. (Morrison)—Described from 1 male, Southern Michigan.

—Boreal of the northern Appalachian region extending through the transition to the dilute edge of the upper austral prairie—2 subspecies indicated.

Ennyommopsis nigrifrons (Syn. *Clista americana* T. female)—1 male, Miami, Florida (Mrs. C. H. T. Townsend); 2 males, South Carolina (Townsend); 5 males, Maryland and Virginia (Crawford and Shannon); 1 male (TD4394) Holyoke Gap, Massachusetts (Townsend); 2 females, Florida and Missouri (Riley); 1 female, Missouri (Bureau Entomology) labeled "Par. on hickory nut Curculio, 7.22.95;" 1 female, Ruston, Louisiana (Hunter No. 1456)—Described from 1 male and 1 female, Carlinville, Ills.—Humid semitropical to austral and sparingly transition lowlands; lower austral in the main.

Eulœwia globosa—1 male, Inverness, Florida (Robertson No. 12417), 4 males, Missouri (Riley), 2 labeled "3090. x" and 1 "3090.o;" 1 male and 1 female, Opelousas, Louisiana; 1 female, Louisiana (H. A. Morgan) labeled "From Chalcodermus;" 11 males and 5 females, Clemson, South Carolina (G. G. Ainslie) reared from *Chalcodermus æneus* (TD511 female, 1710 puparia); 9 males and 9 females, Louisiana, Arkansas and Ada, Oklahoma (Hunter Nos. 1326, 1331, 1390, and 1934), mostly reared from *Anthonomus grandis* but also from other weevils; 2 males, Rio Piedras Verdes in the Sierra Madre of Chihuahua (Townsend) and Chinandega, Nicaragua (Baker); 2 females, Tifton, Georgia (Morrison) and Maryland (Coquillett); 1 female (TD4291), Oak Grove, Virginia (Townsend)—Described from 1 male, Florida; also 1 female (TD509) recorded, White Springs, Fla. (Townsend)—Humid semitropical to middle austral, reaching edge of transition of Sierra Madre region north and south.

Eulœwia madrensis—3 males, Colonia Garcia, Rio Piedras Verdes and San Pedro de Madera in the Sierra Madre of Chihuahua, 7,000 to 8,000 ft. (Townsend); 2 females, Las Visayas in the Sierra Madre of Chihuahua, 7,000 ft. (Townsend) and Mexico City (O. W. Barrett)—Transition of the northern to central Sierra Madre region.

Type: Cat. No. 19670 U. S. N. M. (Male, S. Pedro de Madera.)

NOTE ON BIOGEOGRAPHIC ZONES.

For purposes of geographic ecology, the following main life zones will be found most convenient and have been used in the present paper:

1. Boreal—Humid mountain areas of cool coniferous forest, mainly spruce, fir, aspen, etc.
2. Transition—Humid mountain areas of open pine forest.

3. Upper austral—Humid lowlands and prairies east of the 100th meridian in North America, and arid plains and mesas west of the same meridian terminating in the plateau of south-central Mexico.

4. Middle austral—Same classification as preceding and just south of it or below.

5. Lower austral—Classified same and south of preceding or below it in altitude.

6. Semitropical—Practically all humid lowlands in the east and arid lowlands in the west, but rising on the humid eastern mountain slopes and arid western mountain slopes within the tropics of North America. Includes all of the Florida mainland and what has been known as the Gulf strip of the lower austral. Preëminently a citrus-fruit region, severe frosts being rare but not unknown.

7. Tropical—Humid to arid lowlands and hills where frost is absolutely unknown. Distinctively a cocoanut and royal palm region.

The above definitions are given because they involve some modification of the usually accepted classification.

The main mountain regions of North America are classified in 4 groups: I—Appalachian (the whole eastern system); II—Rocky Mts. (West Texas to Athabasca and Alaska); III—Sierra Nevada (South California to British Columbia including Coast ranges); IV—Sierra Madre (Chihuahua to Central America).

A REMARKABLE NEW GENUS OF CEPHIDÆ.

By S. A. Rohwer,

Branch of Forest Insects, Bureau of Entomology.

The new genus described below is very remarkable because it possesses family characters of two families—Cephidæ and Xiphydriidæ.

The following important group characters of this genus are listed under the family with which they would ally it.

CEPHIDÆ.	XIPHYDRIIDÆ.
Adult.	Adult.
Thorax	Palpi
Basal part of abdomen	Antennæ
	Long malar space and ventral elongation of cheek
	Wings
	Lengthened 8th tergite
	Ovipositor

In all but one of the more recent classifications of the Chalastogastra this genus falls in the family Cephidæ. In the classification proposed by MacGillivray[1] which is based on wing venat on, it falls in the family of Xiphydriidæ.

As the characters in which this genus is like the Cephidæ are less subject to modification by use they indicate that it should be placed in the Cephidæ and that the Cephidæ are the progenitors of the Xiphydriidæ.

Syntexis, new genus.

In Konow's classification in the Genera Insectorum, this genus falls in the Cephini and runs satisfactorily to the genus *Ateuchopus* Konow from which it may be separated by the filiform antennæ and peculiar venation.

Head seen from above subquadrate, the posterior orbits less than half the cephal-caudad diameter of the eye; occiput immargined; malar space long, slightly greater than the width of mandible at base; cheeks produced ventrally; maxillary palpi long, 6-jointed; labial palpi 3-jointed, short, the apical joint as long as first and second, antennæ 16-jointed, second and third joints subequal, the apical joints filiform; pronotum transverse, posterior margin straight with a narrow median emargination; mesosternum with two accessory sutures which separates off a diamond-shaped plate, posteriorly; mesopostnotum large; metanotum separated from the metapostnotum which is fused with the anterior margin of the first tergite; metepisternum and metepimeron elongate, about of equal size, the metepimeron indistinctly fused with the side of the first tergite; posterior coxæ contiguous; tibiæ without supra-apical spurs; claws simple; tergites not margined laterally; the ninth tergite long as in *Xiphydria*, but truncate before the apex and produced beyond the truncation; ovipositor very like *Xiphydria;* subcosta distinctly removed from the costa; radial cell incomplete; stigma hyaline medially; basal vein joining first cubital cell at about the middle; second recurrent received in the second cubital cell, the first recurrent interstitial; transverse median of the fore wings received slightly basad of the middle of first discoidal cell; lanceolate cell with an oblique cross vein and contracted basally; hind wings typical of the Xiphydriidæ except the two discal cells are not defined and the apical veins are obsolete.

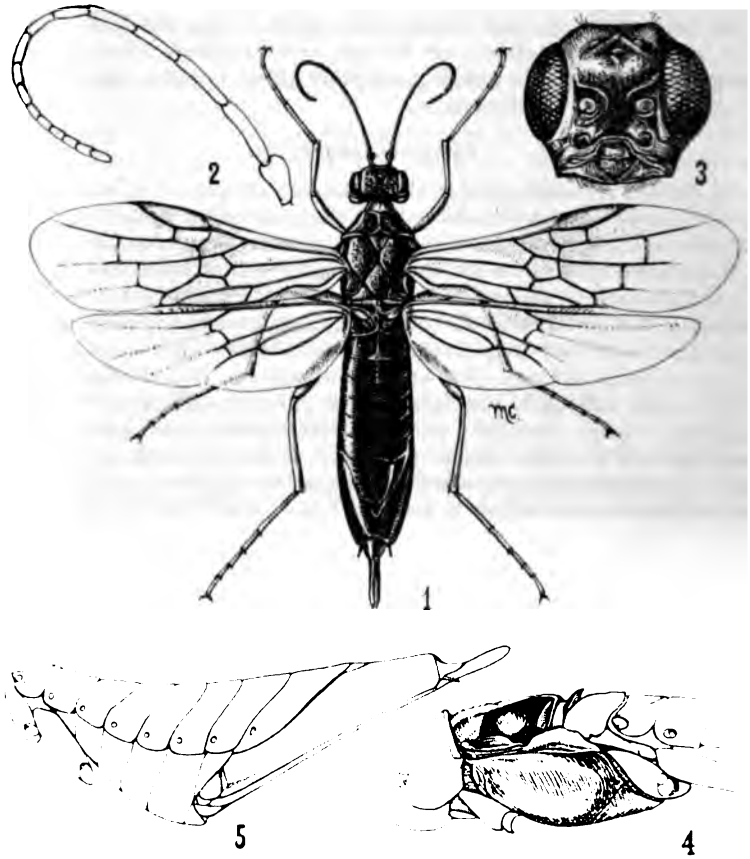
Type: The following new species.

Syntexis libocedrii, new species.

Female. Length to the apex of the abdomen 8 mm.; length of the ovipositor beyond the tip of the abdomen 1.5 mm. Clypeus truncate; supraclypeal foveæ deep, punctiform; head with large irregular punctures which are more distinct and better defined on the frons; median fovea represented

---

[1] Proc. U. S. Nat. Mus., vol. 29, 1906, p. 569–654.



EXPLANATION OF PLATE.

Syntexis libocedrii Rohwer. 1, Adult female; 2, antenna of female; 3, front view of head; 4, lateral view of thorax; 5, lateral view of abdomen. (Drawings by Miss Mary Carmody.)

by a very shallow impression; ocellar basin triangular, open below; facial quadrangle wider than high; pronotum subopaque with sparse tubercles; mesonotum similarly scupltured; mesepisternum and sternum shining, under high magnification, very finely reticulate; tibiæ and tarsi with weak short spines; abdomen shining; sheath nearly parallel-sided, obtusely rounded apically. Black; mandibles and palpi piceous; inner orbits below antennæ, posterior orbits behind the eye, posterior margin of the pronotum laterally and tergites 2 to 8 on lateral posterior margin, *greenish white;* legs beyond the coxæ rufo-testaceous; wings hyaline, slightly milky; venation pale brown anteriorly, pallid posteriorly.

Rose Camp, California. Described from two females recorded under Bureau of Entomology, No. Hopk. U. S. 4996*a* which refers to a note stating that these specimens were reared from larvæ and pupæ collected in the cells near the outer surface of the wood of a large incense cedar (*Libocedrus decurrens* Torr.). Material collected August 8, 1913, and reared June 22, 1914, by H. E. Burke.

Type: Cat. No. 19162, U. S. N. M.

Two poorly preserved larvæ are available for study but they are not in good enough condition to satisfactorily describe. However, as they appear to lack the cerci which occur on the apical sternite below the anal orifice, and have the antennæ more like the Xiphydriidæ it is probable that they are more like the larvæ of the Xiphydriidæ than the Cephidæ.

COMMENSALISM IN DESMOMETOPA.

(*Diptera; Agromyzidæ.*)

BY FREDERICK KNAB, *Bureau of Entomology.*

The small flies of the genus *Desmometopa* have been repeatedly observed under circumstances which indicate a remarkable specialization in habits. There are now on record a series of observations, made independently in widely separated parts of the globe, which all show that these flies feed upon the juices of freshly killed insects; however, unable to themselves kill their prey, they depend upon various rapacious arthropods, with whom they appear to live in more or less close association.

The Hungarian naturalist Ludwig Biró is responsible for the first and at the same time most remarkable observation in this connection. He observed a species, *Desmometopa minutissima,*[1]

[1] Described as an *Agromyza* by Van der Wulp and so recorded by Banks (Entom. News, xxii, 196; 1911). Mik, in the article quoted in the following, has referred the species to its proper genus.

in New Guinea, resting in pairs on the back of an asilid fly, *Ommatius minor* Dol. "They sat on the back of the large fly, between the wings, back to back, so that one of them faced toward the head of the robber-fly and the other toward the abdomen." That their occurrence in this manner was not accidental, Biró determined by further observations. In eight additional cases he found the small flies, as before in pairs and back to back, upon the thorax of the asilid.[1,2] This strange association of these minute flies with the large robber-fly appeared quite mysterious without further knowledge of the habits of the genus. Shortly afterward Joseph Mik, in Austria, found a little swarm of *Desmometopa m-atrum* upon the body of a freshly killed worker-bee dangling on a spider-thread. The bee apparently had been just killed by a spider and the little flies, thirteen in number, were eagerly probing about on the body of the bee, pushing their horny probosces among the body-hairs and in particular probing about the roots of the wings. Mik observed them in their occupation for fully fifteen minutes, before gathering them in, and compared their behavior to that of vultures about a cadaver.[3]

The explanation naturally suggested by this second observation is that the *Desmometopa* found riding on the back of the robber-flies by Biró through this association assured themselves of suitable food. Later observations, made by Biró during a short stay at Amboina, confirmed this conclusion. It seems worth while to give his interesting account in his own words, and to let his other observations on the subject follow.

"In the afternoon hours I withdrew into a young woodland, where first of all *Ommatius minor* caught my eye, as it fluttered before me from one dry twig to another. Naturally from now on I gave it my undivided attention.

"From a distance of a few paces we had taken sharp cognizance of each other. The *Ommatius* was not resting empty-handed, but held between its claws the dead body of a trigoniid cricket; I could not detect his riders. Although quite close, I nevertheless took out my opera-glasses and began to observe him through them. Thereby I found at once the solution to this apparently strange association. I immediately detected the *Agromyza* [=*Desmometopa*], and moreover three of them, as they were probing about the prey. *Agromyza minutissima* is therefore the

[1] Kertész, Koloman. Új-Guinea Légy-Faunájából. Dipterologisches aus Neu-Guinea. Termesz. Füzetek, vol. 20, p. 611-613. 1897.

[2] Biró, Lajos. Asilida és lovasa. Rovart. Lapok, vol. 4, p. 129. 1897.

[3] Mik, Josef. Merkwürdige Beziehungen zwischen Desmometopa M-atrum Meig. aus Europa und Agromyza minutissima v. d. Wulp aus Neu-Guinea. Wien. Ent. Zeit., vol. 17, p. 146-151. 1898.

commensalist of *Ommatius minor!* The insects hopped nimbly about the body of the cricket, stopped to feast, ran up onto the back of the robber-fly and again descended to the branch, ran and flew rapidly about, and could not rest for a minute.

"It still remained for me to check the correctness of my observations. Afterwards I amused myself for hours, partly with these first associates, partly with others found in these woods, where *Ommatius* was far from being a rarity. * * *

"In the woods of Amboina I captured the whole of one of these partnerships, then first released the *Agromyzas*, and afterward the *Ommatius*. It was easy to recapture the robber-fly, as it soon settled again at a distance of fifteen or twenty paces, and, although now more shy, I could, with sufficient patience and equipped with a long-handled net, recapture some individuals three or four times. To my astonishment the little flies had again all congregated upon its back.

"I still wanted to determine whether these were always the same individuals of *Agromyza*. For this reason I drove a specimen into the tip of the net and with the forceps tore a minute piece from its wing; made recognizable in this manner, I perceived that it came back twice, although upon the second instance I had released it at a distance of ten or twelve paces. Afterwards I facilitated the experiment by simply tethering the *Ommatius* to the end of a twig.

"However, not every *Ommatius* has its companion flies; many forage about without them. Some harbor only one, some two or three flies, but never more.

"The fidelity of the *Agromyza* is praiseworthy. It does not easily change its host. I tethered some robber-flies caught flying about unaccompanied to a branch and then released near them some of the little flies whose host I had killed. All scattered and none adopted the host selected for them."

As will be seen from the foregoing, Biró was not aware that the flies he had found associated with *Ommatius* belong to the genus *Desmometopa*, but they reminded him vividly of the *Desmometopa* which he had observed repeatedly in southern Europe. When collecting he had never found *Desmometopa* alone, but always about the prey of some predaceous insect that had just captured a bee, wasp, fly or butterfly. He was first of all impressed by the fact that these little flies showed no fear of spiders, but, on the contrary, boldly participated in their meals. Later he often saw them associated with flower-inhabiting spiders (*Misumena* and *Thomisus*), as well as with Asilidæ.

"Most frequently I found them in the region of Fiume and Buccari at the time when *Palurus aculeatus* blooms. The flowers

harbor the large predaceous bug, *Harpactor iracundus*, which commonly hunts the workers of *Apis mellifica*. The pollen and sweet juices covering its body attract many *Desmometopa m-nigrum*. As long as *Harpactor* lies in wait, no flies appeared; but as soon as the table was set, they immediately gathered about. It appeared to be their determination to feast only in the presence of the hunter, for when I had removed the *Harpactor* I offered them the body of the bee in vain; none came to it. But I succeeded in deceiving them by placing beside the bee the killed bug. Furthermore, they must have a good sense of smell, for a dried *Harpactor*, or one killed some hours previously, failed to attract them.

"At Singapore I met with *Desmametopa* flies again in April of this year. One night I collected a nest of *Apis florea* Fab., var. *andreniformis* Sm. with its entire inhabitants, and from the following noon on single small flies came flying to the dead bees and the cells laid out to dry. They were easily recognizable by the M-shaped mark on the frons and in their movements and manner of flight behaved entirely like their European relatives."[1]

This last observation induced Biró to incline to the belief that the European *Desmometopa* also might be attracted, if a large quantity of dead bees and comb were suitably exposed. Still another observation made by Biró in Singapore is quoted by Kertész in connection with the original description of *Desmometopa singaporensis*.[2] According to Biró's note, this species "lives in the same manner as the European species and appears at once when a spider or *Harpactor* kills a bee."

More recently Dr. Carl Lundström, in Sweden, confirmed a part of Biró's statements by independent observation. "On June 17 of last summer (1905) I observed a swarm of from 20 to 40 small black flies flying about on the flower-heads of a bush of *Cornus alba* in the garden of Julla in Kunstö. By close observation I saw that it was not the flowers that attracted the flies, but a recently killed bee which a spider was clasping around the head and sucking. Unceasingly some of the small flies alighted upon the abdomen of the bee, stayed there for a moment, and then flew up to rejoin the swarm and make room for others of the flies; but during the whole time the swarm itself remained in the same position, flying around the bee."

Lundström caught some of the flies, and of six specimens pre-

---

[1] Biró, Ludwig. Asztalközösség a legyeknél. Commensalismus bei Fliegen. Termesz. Füzetek, vol. 22, p. 196-199, 200-204. 1899.

[2] Kertész, Koloman. Verzeichniss einiger von L. Biró in Neu-Guinea und am Malayischen Archipel gesammelten Dipteren. Termesz. Füzetek, vol. 22, p. 173-195 (Biró quoted, p. 195). 1899.

served, four belonged to *Desmometopa m-atrum* Meig., and two to *D. m-nigrum* Zett. The spider was a full-grown female of *Misumena vatia* Cl. At that time Lundström was not acquainted with Biró's observations and had only read the article by Mik. He therefore sought to determine more closely the possible relation of *Desmometopa* to the bees. By catching bee after bee, he satisfied himself that the flies do not travel with them. Freshly killed bees pinned to the flower-heads of *Cornus alba* failed to attract them, and bits of white paper with honey spread on them also gave a negative result. Lundström concluded that *Desmometopa* associates with predaceous insects and "immediately after eclosion from the pupa seeks a spider or predaceous insect, to remain associated with it thenceforth and feeding only upon the remains of its prey." In his opinion it is only in this manner that the seeming rarity of these flies, abundant enough under proper conditions, can be accounted for.[1]

Finally, C. A. Frost, in a short note, has indicated that in America *Desmometopa* has similar habits, the species observed by him (*D. latipes* Meig.) being indeed found in both hemispheres.[2] All these observations indicate that commensalism in *Desmometopa* is a well fixed habit, furthermore showing some additional specialization in certain species.

Under the head of "Notes and Exhibition of Specimens," the following were presented:

MIGRATING ARMIES OF MYRIOPODS.

By H. S. Barber, *Bureau of Entomology.*

Just before dusk one day near the end of May, 1903, a surprising migration of myriopods was observed by the writer, the army issuing from the Redwood forest on one side of a logging railroad at Fieldbrook (Buckman), Humboldt Co., Cal., crossing the track on both sides of a little hollow spanned by a short trestle and entering the woods on the other side of the cleared right-of-way. The width of the marching army was perhaps 120 feet, and the width of the cleared right-of-way was about 200 feet. One could not walk in this area without crushing many at each step and it was difficult to count the rapidly moving

[1] Lundström, Carl. Om Desmometopa-arternas snyltgästning hos spindar och rofinsekter. Meddel. Soc. pro Fauna et Flora fennica, Heft. 32, p. 100–104. 1906.

[2] Frost, C. A. Peculiar habits of small Diptera, *Desmometopa latipes* Meig. Psyche, vol. 20, p. 37. 1913.

myriopods in such a small area as a square foot. Several attempts at such a count gave the impression that there were from fifty to one hundred individuals per square foot. All were travelling in the same general direction—westward—but their ranks were denser in places and towards the edges of the army there seemed to be more or less distinct columns. Specimens taken for the National Collection were of a pale color, less than an inch in length and looked like half grown individuals of our eastern *Fontaria*, but have never been determined.

About two weeks after the observation just described the writer saw quantities of what he supposed to be the same species lying dead at the foot of an exposed vertical bank near where the Hoopa Trail crosses Redwood Creek at Bair's Ranch, perhaps 25 miles east of Fieldbrook and not in the Redwood Belt. He believes this mortality could be explained by supposing that part of an army similar to that just described was crossing the face of this bank when the early morning sunlight overcame them and killed those which rolled to the bottom where there was no shelter from the sun. In the same way he had seen other unpigmented inhabitants of the peaty soil of the dark forests such as small myriopods, springtails, and even pale, blind beetles stimulated to violent activity ending in a few moments in death, while he was sifting in the bright sunshine.

Mr. Banks has kindly referred the writer to the paper by Bollman 1888 (Ent. Amer. vol. 4, p. 3) where *Fontaria virginiensis* Drury is reported to have been found crawling on the surface of the ground in large numbers at Donaldson, Ark., July 11, 1887, there being perhaps one adult among five or eight hundred young. The only other accounts of such mass migrations of myriopods known to the writer are contained in letters from Mr. Fred E. Brooks, dated July 13 and August 6, 1908, transmitting specimens of *Fontaria brunnea* from Weston, West Virginia, to the Bureau of Entomology, and stating that they evidently emigrated from the woods, and, moving in armies, invaded dwelling houses and outbuildings, fell into springs and wells and in some cases died in such numbers as to emit a strong stench. In one case the walls of a cellar where they congregated were washed down with hot water several times during their four days' visit at that place and each time two or three gallons of myriopods were taken out. Perhaps a dozen such armies in that section of West Virginia had at that time been reported to Mr. Brooks, who has just replied to a recent inquiry, as follows: "Since writing the letters referred to by you, I have observed migrating armies of the myriopods several times but never in so great numbers as were observed at Weston in 1908. Almost every year I hear of such armies

somewhere in central West Virginia and I think the phenomenon is an annual occurrence here. A friend of mine at Gaston, W. Va., has informed me that a few years ago an army of the myripods invaded and took up their quarters in his strawberry field. They were present at the time the fruit was ripening and were so numerous that it was practically impossible for him to gather his crop of fruit. The creatures collected around and fed on the over-ripe fruit. I heard of another instance where an army covered an old boardwalk and fed on the damp and decaying surface of the boards until the discolored portion was all scraped away so that the boards looked like they had been newly made."[1]

FRAGMENTARY NOTES ON THE LIFE-HISTORY OF THE MYRIOPOD, SPIROBOLUS MARGINATUS.

By H. S. Barber, *Bureau of Entomology.*

The large common julid, *Spirobolus marginatus*, as determined by Dr. O. F. Cook, is the principal prey of the giant glow-worm *Phengodes laticollis* Lec., in the vicinity of Washington, D. C., and in breeding experiments with this beetle several thousand individuals of the myriopod have been used as food. In securing this food supply for the beetle larvæ some observations have been made which it may be well to put in available form. Mr. Coville has cited this species (Journ. Wash. Acad. Sci. vol. 3, pp. 81–82 and Ann. Rep. Smithsonian, 1913, p. 337.) as one of the important factors in the reduction of the leaf litter into humus, and has alluded to its abundance in restricted localities along the banks of the Potomac River near Plummer's Island where these observations have been made.

Throughout the warmer part of the summer the species is to be found above ground in the dark woods during daytime, but its chief habit is to hide beneath the leaves or under bark of dead logs, except during the night when it is crawling about, eating the lichens from the rocks and the weathered surfaces from the logs or the bark of the trees. Most of its food consists of decaying leaves or rotting wood. Specimens of all sizes from less than one inch to about three inches in length can be found under these conditions from early May until late fall, but there are fluctuations in the numbers in which they appear, which the writer does not understand.

---

[1] More recently (July 3, 1915) H. A. Gossard has reported a similar abundance at McArthur, Ohio, where a species (possibly *F. coriacea* Koch,—Banks' determination) was extremely numerous, covering the ground in places and causing much annoyance by getting into wells and springs, but otherwise apparently not doing much damage.

Mating takes place at night on the tree trunks. To endeavor to find where the eggs are laid, about twenty large specimens of both sexes were taken in early May and confined in a deep jar filled with ordinary leaf litter and set in the ground. By the end of July young had appeared in the jar although it had previously been examined without finding eggs. At this time, however, it was discovered that in most cases the excrement pellets were not solid but consisted merely of a thin shell surrounding a comparatively large cavity in which the small brown-skinned egg was lying loose. These pellets showed no external differences from the solid normal pellets cast by large individuals of the species, but when exposed to the air for a few minutes the color changed slightly on account of the more rapid drying out of the thin shell. About a pint of both kinds of pellets was placed in tin boxes where they could be frequently examined. By the middle of August most of the young myriopods had devoured their enclosing pellets and were feeding on the solid ones. They measured 8 mm. in length and had seven pairs of legs, but some were moulting into a slightly longer, many-legged (35 pairs) form. Before the middle of September they had reduced all of the frass pellets in the tin into a mass of very fine frass and were crawling on its surface seeking other food. They congregated on bits of rotten wood that were introduced and began feeding, but the condition of this rotten wood was apparently unsuitable, and a few days later all were found dead on the surface, many having had all their legs eaten off by those who survived the longest.

The writer has been unable to find intermediate sizes between these small (10 mm.) larvae and those of about an inch in length which are found living free, but he has sometimes found rotten logs in a peculiar state of moist, brittle, almost black decomposition in which great numbers of young *Spirobolus*, one to one and a half inches in length, were living, each in its cell and usually with the remains of one or more cast skins in the same cell. These cells apparently had no external opening and the myriopod was developing by eating away the inner surface of the cell. One such log seen by the writer several years ago had been recently deposited by a freshet on a sand-bar in the river and hundreds of full-grown myriopods were leaving the log and crawling over the sand in all directions away from it. The writer believes that young myriopods enter such rotten wood after freeing themselves from the egg pellets.

The very slow rate of growth of the young larvae and the fact that at anytime at least four distinct sizes of immature myri-

opods may be found indicate that the development of the individuals to maturity is a very slow process and it is now expected that such development from egg to egg-laying adult will require four or more years.

As Mr. Coville has indicated, the rôle played by the species is that of a reducer of the waste material in the forest. From the peculiar symbiotic relationship upon which the digestion of such myriopods is said to be dependent it would appear that anything upsetting the balance of this interdependence would react against the myriopod. Under the original continuously forested condition of the eastern United States the distribution of these myriopods was probably much more general but now they are found in comparatively circumscribed colonies so that the chief enemy of the species may be the indirect influences affecting the forest conditions. The older myriopods are well protected against general predators by a strong acid secretion of the lateral pores, but there are two enemies to whom this secretion seems to act as an appetizer. The larvæ of *Phengodes* appear to feed only upon this and allied myriopods and in the combat that follows the attack of one of these beetle larvæ both the larva and the victim become entirely covered with the offensive yellow secretion which appears to cause certain death to almost any other insect larvæ that may be confined in the jar with them. Mr. Banks and others[1] have described the attacks of a small parasitic phorid fly (*Aphiochæta xanthippe* Banks, 1911 = *juli* Brues, 1908) which appears generally to breed in other small julids and whose presence causes very great annoyance to all sizes of *Spirobolus*, yet no observation has been made to prove that the fly is actually able to breed in *Spirobolus*. On two or three occasions large sarcophagid (?) larvæ have been found in dead *Spirobolus* in the woods, but no proof of parasitism came to the writer's notice until Mr. W. S. Fisher told him of the attack of a large fly on an apparently healthy myriopod which frantically tried to escape, but on which he found several freshly deposited larvæ. He failed to catch the fly but saved the *Spirobolus* for breeding. It lived five days and from it he preserved a larva and a pupa of the parasite but unfortunately reared only

---

[1] Knab's short note on this species (Ins. Ins. Mens., vol. 1, 1913, p. 24) cites the following references to its habits:

1884 Lintner, Can. Ent., vol. 16, p. 80.
1884 Dimmock, Can. Ent., vol. 16, p. 80.
1908 Brues, Journ. N. Y. Ent. Soc., vol. 16, p. 201.
1911 Banks, Proc. Ent. Soc. Wash., vol. 13, p. 212.
1912 Malloch, Proc. U. S. Nat. Mus., vol. 43, p. 459.

a single female fly and the male is said to be necessary for determination in the genus *Sarcophaga*.[1]

No satisfactory account of the life cycle of any myriopod has been seen by the writer. Much space is given to the embryology of a few species, but the food of the young, the time occupied by the various stages and the habits of the species are omitted. Sinclair (Cambridge Nat. Hist. 1895, vol. 5, pp. 37–38) describes the preparation of the nest in which *Julus terrestris* deposits and seals up its 60 to 100 eggs, and Morse (Ohio Nat. vol. 4, 1904, pp. 161–163) tells of a somewhat similar habit observed in *Fontaria indianæ* but seems to believe that the eggs are laid through the generative opening on the second body segment which the present writer believes improbable.

Two Hundred and Eighty-Fifth Meeting, April 1, 1915.

The 285th regular meeting of the Society was entertained by the bachelor members at the Sængerbund Hall, April 1, 1915. There were present Messrs. Abbott, Banks, Barber, Böving, Busck, Cory, Craighead, Crawford, Cushman, DeGryse, Ely, Fisher, Gahan, Greene, Heinrich, Hood, Hutchinson, Isely, McGregor, Rohwer, Sasscer, Schwarz, Shannon, Snyder, and Walton, members and Mr. A. C. Johnson, visitor.

In the absence of the President the First Vice-President presided.

The following resolution of the Executive Committee was read and on motion of Mr. Barber adopted: "That the Society shall set aside all money received after January 1st, 1915, other than that received as initiation fees, dues or subscriptions, as a separate fund which shall be known as the publication fund. This fund may also be increased by private subscription or may be increased by the balance on hand at the end of any fiscal year provided that the Executive Committee empower the treasurer to transfer such balance to the publication fund.

[1] Mr. Fisher's data are as follows: Parasitized millipede collected at Inglenook, Pa., June 14, 1912, died from injury of parasitic larvæ June 19. On June 27 five larvæ emerged from the dead millipede, one larva preserved in alcohol. On June 28, the four larvæ pupated, the one pupa preserved. July 11, one adult emerged.

"This fund shall be invested under the direction of the Executive Committee and the income only may be used for publication."

The following papers were presented:

A REVIEW OF HENRIKSEN'S CERAMBYCID LARVÆ IN DANMARK'S FAUNA, BILLER III, TRAEBUKKE, 1914.

By F. C. Craighead,

Branch of Forest Insects, Bureau of Entomology.

In one of the series of papers devoted to the fauna of Denmark, A. C. Jenson-Haarup has discussed the longhorn beetles and K. Henriksen their larvæ.

Henriksen has given a brief and concise discussion of the anatomical and biological characteristics of these larvæ. Following this is a table to subfamilies, genera and species. These are constructed with the idea of quickly identifying the species rather than to illustrate any taxonomic relationships. The most conspicuous characters are used. This has been the first attempt to formulate dichotomous keys for the whole family, which has been avoided by former writers on these larvæ. The arrangement of subfamilies essentially follows the excellent work of Schiödte. Original figures illustrate the chief anatomical characters and for nearly every species the dorsal ampullæ is figured. In the reviewer's opinion too much stress is laid upon the value of these ampullæ. The arrangement of the impressed lines is often intensified or obliterated according to the manner in which the larvæ have been preserved. The structure of the mandibles and ventral mouth parts is very reliable, and can be used as well for cast skins.

Fifty-one species are treated. A brief description of each and the food habits are given. A typographical error occurs under *Pachyta collaris*. It is described with two ocelli instead of five, as given in the table.

A word of comment is necessary on this series of papers describing the Danish fauna. They are more or less popular, prepared for the general public but technical enough to accurately identify the species. A large number of volumes prepared by well known experts on each subject have been published, covering birds, mammals, fishes, reptiles, insects, etc. It favorably reflects on a public that can appreciate and demand such publications.

AN INTERESTING CASE OE ANTENNAL ANTIGENY IN THYSANOPTERA.

By J. Douglas Hood, *United States Biological Survey.*

Sexual differences of both color and structure are very common in Thysanoptera. Usually these differences are minor, but they can no doubt be detected in every species. Occasionally the antigeny produces a dissemblance in habitus which in a few instances has led to the assignment of the sexes to different species or even genera. The dimorphism may appear in any part of the body. It concerns the form of the head in *Trichothrips flavicauda;* the size, form and armature of the three distal segments of the fore legs in nearly all species of Tubulifera; the size and structure of the prothorax, particularly in the Phlœothripidæ; the armature of the pterothorax in the genus *Dinothrips* and of the abdomen in *Kakothrips* and the Megathripidæ;—as well as affecting in numerous ways several other parts of the body of various species. Thus, ocelli and wings are wanting in the males of *Chirothrips* and *Limothrips;* and in the males of most Thripoidea the abdominal sternites have pale sensory areas of constant form and arrangement. Frequently, too, the color of the male is radically different from that of the female.

The antennæ, however, are usually very stable, differing but little with sex, among individuals, or even in different species of the same genus. Many genera are separated on the strength of such characters; and recently a new family has been erected for two European species whose antennæ depart distinctly from the general plan of the group to which they belong.

The occurence in the United States of a species whose female has antennæ of normal form and structure but whose male has these organs so modified through the reduction in size of certain segments, the increase in size of others, and the multiplication of sensory hairs of their surface, must thus be of importance in its effect upon our conceptions of generic characters. While such sexual anomalies should perhaps not in themselves be made the basis for the separation of new genera, they nevertheless point to a probable difference in phylogeny and lead to a search for correspondingly important characters in the opposite sex. In the case of this species such characters are found in the form of the head, the position of the anterior ocellus, the proportionate lengths of the antennal segments, the narrowed prothorax, and the vestigial condition of the ovipositor. It is thus proposed to remove *Thrips perplexus* (Beach) from the genus *Thrips* and to erect for it the new genus described below.

Plesiothrips gen. nov.

(πλησίος, near; θρίψ, a wood worm.)

Body depressed. Head scarcely wider than long, usually broadest across eyes and constricted behind them, triangularly produced in front, sides about parallel between eyes and base of antennæ, the anterior ocellus completely anterior to front margin of eyes. Eyes prominent, protruding, much narrower than their interval. Antennæ seven-segmented, the fourth longer than the third, the seventh slender, males with distinct accessory "ring-joint" at base of segments 4 and 5; antennæ of female nearly normal in structure, those of male with third and seventh segments small and the fourth to sixth elongate and bearing many long hairs which have no analogue in the female; sense cones on segments 3 and 4 forked in both sexes. Maxillary palpi three-segmented. Prothorax of female about as long as head and but very little wider, that of male distinctly shorter; two pairs of long bristles at posterior angles. Wings long and slender, the spines on anterior margin of fore pair long and slender, barely distinguishable from the fringe. Abdomen of the female conical at tip, spines in both sexes long and slender; ovipositor vestigial; ninth abdominal tergite of male with a pair of long, heavily chitinized, finger-like processes arising from strong tubercles on posterior margin, in addition to four pairs of long bristles, of which an approximate median pair are shorter.

Type: Sericothrips ? perplexa Beach.

In addition to the characters furnished by the antennæ and tip of the abdomen in the male, *Plesiothrips* may be separated in the female sex from *Thrips* and *Bagnallia* by the produced head, the position of the anterior ocellus, the elongate fourth antennal segment, the narrow prothorax, and the almost complete absence of an ovipositor. The appearance of "ring-joints" through an actual breaking up of antennal segments is significant, indeed, pointing to the possibility of evolution in the order through an increase in the number of segments. Reduction by fusion is of common occurrence.

Plesiothrips perplexus (Beach).

(Plate XV, Figs. 1–4.)

1896. *Secicothrips ? perplexa* Beach, Proc. Iowa Acad. Sci., Vol. III, p. 216. (Ames, Iowa; on *Cyperus*, corn, and grass.)

1902. *Thrips perplexus*, Hinds, Proc. U. S. Nat. Mus., Vol. XXVI, p. 184, Pl. VI, figs. 66–68, Pl. XI, fig. 123. (Amherst, Mass.; on grasses.)

1913. *Thrips perplexus*, Morgan, Proc. U. S. Nat. Mus., Vol. 46, p. 44. (Florida and Tennessee; grasses, sod and cedar.)

Female (macropterous). Both Miss Beach and Dr. Hinds (loc. cit.) have written good descriptions of this sex, and Hinds gives four figures. Detailed measurements are given below, and on Plate XV, figures 3 and 4 illustrate the head and prothorax and the antennæ.

Measurements: Length 1.06 mm.; head, length 0.123 mm., width 0.135 mm.; prothorax, length 0.126 mm., width 0.153 mm.; pterothorax, width 0.204 mm.; abdomen, width 0.198 mm.; wings of fore pair, length 0.660 mm., width at base 0.057 mm., at middle 0.041 mm.

Antennal segments:	1	2	3	4	5	6	7
length (μ)	24	33	40	50	36	60	28
width (μ)	32	24	22	22	17	18	8

total length of antenna, 0. 271 mm.

Male (macropterous). Length about 0.9 mm. Color blackish brown, with tarsi, apices of tibiæ, pedicel of third antennal segment, and five or six basal abdominal segments yellowish; thorax with orange-red hypodermal pigment; fore wings brownish gray, nearly clear in basal third, beyond which and at tip they are slightly darker.

Head more slender than in female and slightly longer than wide. Antennæ (Plate XV, fig. 1) with third and seventh segments small, and the fourth and sixth elongate and bearing many long hairs; pedicels of segments 4 and 5 distinctly separated from segments themselves and freely movable.

Prothorax 0.8 as long as head and about 1.4 times as wide as long.

Abdominal sternites 3 and 4 with a pair of small, circular, pale areas at lateral third; tergite 9 (Plate XV, fig. 2) with a pair of long, heavily chitinized, finger-like processes arising from strong tubercles on posterior margin, in addition to four pairs of long bristles of which an approximate median pair are shorter.

Measurements: Length 0.88 mm.; head, length 0.120 mm., width 0.115 mm.; prothorax, length 0.096 mm., width 0.138 mm.; pterothorax, width 0.180 mm.; abdomen, width 0.120 mm.

Antennal segments:	1	2	3	(4)	4	(5)	5	6	7
length (μ)	24	30	30	3	59	3	44	84	15
width (μ)	30	24	21	8	20	8	18	18	3

total length of antenna, 0.292 mm.

Distribution:

Iowa.—Ames, August and November (Beach).

Massachusetts.—Amherst (Hinds).

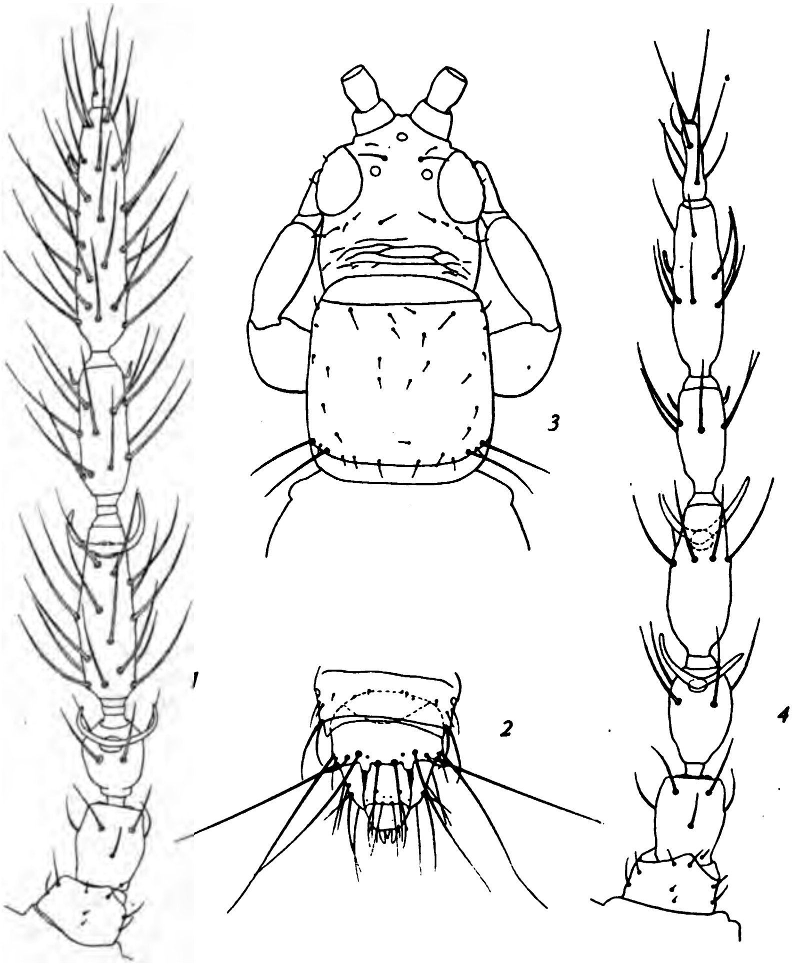
Florida.—Quincy, September 8, 1909 (Morgan); Orlando, November 4, 1914, C. B. Williams, 2♂'s.

Tennessee.—Clarksville, April 2, August 19, and October 15, 1910 (Morgan).

Maryland.—Plummer's Island, July 27 and September 14, 1913, J. D. H., 2♀'s.

District of Columbia.—Washington, November 3, 1914, J. D. H., 2♀'s.

Illinois.—Anna, Bondville, Carbondale, Clay City, Havana, Hillery, Makanda, Muncie, Odin, Pulaski, and Urbana, throughout the year, 11♀'s and 10♂'s.



PLESIOTHRIPS PERPLEXUS (BEACH),

Fig. 1. Male, left antenna.
Fig. 2. Male, segments 8–10 of abdomen.
Fig. 3. Female, head and prothorax.
Fig. 4. Female, left antenna.

Texas.—Brownsville, December 8, 1910, C. A. Hart, 1 ♂.

In my experience, this species is restricted entirely to grasses, where the adults occur throughout the year at the base of the leaves, in the region of the axils. Morgan records it also from cedar, but this record is probably based on a single female which had paused in flight. The life habits are thus quite different from those of the species of allied genera, all of which live in more or less exposed situations in the flowers or on the leaves of plants. The ovipositor may have degenerated from disuse, the necessity for the insertion of the eggs in plant tissue to secure protection having disappeared with the changed habitat of the insect. In this respect, as Dr. Hinds remarks, the species shows a divergence toward the Tubulifera, which lay their eggs wholly externally. It should be added that so great is the reduction of the ovipositor that Miss Beach in describing the species was led to believe her specimens all males, whereas they were really all females. She directed attention in her discussion of the insect to the depressed head, the produced front, the position of the ocelli, and the elongate fourth antennal segment.

DESCRIPTIONS OF NEW ICHNEUMONIDÆ AND TAXONOMIC NOTES.

By R. A. Cushman, *Bureau of Entomology*.

The present paper consists largely of descriptions of new species of economic importance, together with some notes on previously described species and genera and the designation of a new genus.

Calliephialtes thurberiæ n. sp.

In color and markings this species is very like *Pimpla notanda* Cress., which should also be referred to *Calliephialtes*, but in structure and in the white lower surface of the scape and pedicel in the male it is more closely allied to *grapholitha* Cress.

Female Length 9 mm.; ovipositor 8 mm. Face as wide as long and with a short median carina below the antennæ; distance from side of clypeus to eye much shorter than malar space; eyes slightly emarginate within; postocellar line sub-equal to the ocell-ocular line; occiput but weakly excavated; head throughout polished and impunctate; pro- and mesothorax polished and practically impunctate; notauli distinct anteriorly, the prescutum, viewed from above, subtruncate; foveolate furrow of mesopleura obsolete above position of punctiform fovea, the latter scarcely impressed; carina between metapleura and propodeum not obsolete in front of spiracle; propodeum polished, with scattered punctures laterally; nervellus broken at about the middle and at a distinct angle; first tergite

about as wide apically as long, much shorter than second, anterior excavation polished, carinæ obsolescent, sparsely punctate apically and more strongly so laterally; tergites 2–5 similarly punctured, the elevations on 3–5 nearly impunctate.

Black with mesonotum laterally, scutellum entirely, and postscutellum apically, rufous; spot below the tegula, mesosternum and pleuræ below, hind coxæ and all femora ferruginous; mandibles pale at base; pedicel beneath and scape narrowly at apex, palpi, front and middle coxæ, trochanters, except basal joint of hind pair, tegulæ and line on pronotum, whitish; hind tibiæ with a yellowish longitudinal stripe below which entirely embraces the tip, upper side whitish with small infuscated spot near base; remaining portions of legs pale stramineous with the hind tarsal joints darker apically; wings hyaline, veins and stigma fuscous white at base.

Male. Length 8.5 mm., antennæ 5.5 mm. Differs from female as follows: face relatively somewhat longer; ocell-ocular line somewhat shorter than postocellar line; first tergite about one-third longer than wide, polished medially.

The ferruginous color is paler throughout and embraces the entire mesonotum and metapleuræ in addition to the areas enumerated in the description of the female; legs paler, front and middle pairs largely white.

Host: Anthonomous grandis thurberiæ Pierce.

Type locality: Santa Rita Mts., Ariz.

Type: Cat. No. 19157, U. S. N. M.

Described from two females and a male reared from larvæ of the host in bolls of *Thurberia thespesioides*, the females from material collected by Mr. E. A. Schwarz, April 12, 1913, in Stone Cabin Canyon and the male from material collected by Mr. Schwarz March 12, 1913 at McCleary's Ranch, both localities in the Santa Rita Mts. The paratype female is almost identical with the type.

(Pimpla) Calliephialtes grapholithæ (Cress.)

Synonym.—*Calliephialtes xanthothorax* Ashm.

GENUS HOMASPIS Foerster.

The only character used by Foerster to separate this genus from *Notopygus* Holmgren is the lack of an areolet in the front wing. The genotype, *H. rufinus* (Grav.), has the areolet, while Davis's two species and the one described below lack it. Better characters for separating the two genera are found in the apically impressed clypeus in *Homaspis* and its slender legs, the hind tibiæ being much longer than their femora, while in *Notopygus* the hind tibiæ are very stout and hardly longer than their femora.

Homaspis nigripes, n. sp.

Distinct from either of the two species described by Davis in its larger size and its largely black legs.

Female. Length 16 mm. Head transverse, the temples rather broad and strongly rounded; clypeus hardly more than a fourth as long as wide, sparsely punctured and obscurely transversely rugulose; eyes nearly touching the mandibles, parallel within and broadly, weakly emarginate; face nearly twice as wide as long, gibbous immediately below the antennæ, flat below, rather coarsely, densely punctured; front impressed on each side above the antennæ, scupltured like the face but smooth in the impressions; vertex and temples weakly punctured; ocell-ocular and postocellar lines equal and somewhat greater than diameter of lateral ocellus; thorax weakly, densely punctured, notauli rather weak; propodeum with eight areas, five basal and three apical, areola and petiolar area separated, areola polished, the other basal areas weakly punctured and apical areas more or less transversely rugulose; spiracle oval; abdomen slender, its sides very gradually divergent nearly to apex, weakly punctured; first tergite four times as long as apical width, parallel sided before the spiracles, which are placed somewhat beyond the middle, half as wide at spiracles as at apex, dorsal carinæ weak, fading out shortly beyond the spiracles, but with a weak median impression extending somewhat further; second tergite about two-thirds as long as first with weak median impression; third and fourth subequal to second, fifth only about a third as long as the others, mostly hidden above; wings without areolet; nervellus broken slightly above middle; hind tibiæ somewhat longer than their tarsi and about a third longer than their femora.

Black with abdomen, except basal three-fourths of first tergite, rufous; clypeus, mandibles, except apices, inner orbits below, irregular spot in middle of face, scape beneath, spot above eye, and scutellum above, yellow; wing bases, tegulæ, spots in front and below tegulæ, front coxæ outside, two small spots on middle coxæ, front and middle tibiæ and tarsi and apices of their femora, and articulation between hind femora and tibiæ white; legs otherwise black, the front and middle ones somewhat piceous; wings yellowish-hyaline.

Type locality: Estes Park, Colo.

Type: Cat. No. 19304, U. S. N. M.

A single specimen taken by F. H. Snow August 1892 and bearing the label U. of K. Col. Lot. 153.

Notopygus scutellatus n. sp.

In my table[1] to the North American species of this genus this species runs closest to *virginiensis* Cush., from which it is at once distinguishable by its pale scutellum, postscutellum, and front and middle coxæ and its apically black hind tibiæ and tarsal joints.

[1] Proc. U. S. N. M., vol. 48, 1915, p. 511.

Female. Length 15 mm.; antennæ 12 mm. Differs from *virginiensis* Cush. as follows: antennæ black with an obscure indication of a pale annulus about two-thirds of the way to tip; tapering apically, flagellum 45-jointed (in type of *virginiensis* tips of antennæ are broken off); propodeum with middle area transversely rugose at top of posterior declivity, spiracle rather large oval (in *virginiensis* the spiracle is small and round); scutellum and postscutellum, tegulæ and spots in front and below, yellow; hind coxæ black, front and middle coxæ yellow, testaceous at base; all trochanters yellow, those of hind legs somewhat darker; front and middle femora testaceous, yellow at base and apex; hind femora black, yellow at base and apex; front and middle tibiæ and tarsi pale testaceous, the tibiæ yellow at base; hind tibiæ yellow at base, black at tip, their tarsi yellowish, the joints apically infuscate; abdomen piceous-black with apical segments and ovipositor yellowish; first tergite apically, second entirely, except an obscure dark spot on each side of middle, and basal half of third testaceous; first tergite similarly though less coarsely sculptured, its sides arcuately divergent beyond the spiracles (in *virginiensis* the sides beyond the spiracle are at first concave then arcuate); second tergite with carinæ weak, more finely punctured; remaining tergites polished, minutely punctured.

Type locality: Cornwall, Idaho.
Type: Cat. No. 19299, U. S. N. M.
A single specimen taken by C. V. Piper on August 1, 1898.

(Monoblastus) Trematopygus caliroæ (Viereck).

The types of *Monoblastus caliroæ* Vier., described from specimens reared by the present writer from *Caliroa cerasi*, run in Davis's table to this genus, and agree very well with his description of *fusculosus* Davis. Davis's description is based on the male sex only. Before me are the two females and the male of the type series of *caliroæ* Vier. together with a male and a female taken by me on cherry trees badly infested with pear slug at North East, Pa. The males have all of the characters mentioned in the description of *fusculosus* and in addition have the apical tergites somewhat infuscated. The females differ from the males in having the wings somewhat paler, the first tergite red except the extreme base and the carinæ, the apical tergites red, and the pale color of the coxæ, mandibles, trochanters and tegulæ more reddish.

Trematopygus eriocampoididis n. sp.

In Davis's table to the genus this species will run to *fusculosus* Davis, but differs from that species and *caliroæ* (Vier.) in having the abdomen entirely black.

Female: Length 5 mm.; antennæ 6 mm. Face polished, sparsely, minutely punctured, and with a very small, rounded tubercle medially below

the antennæ; clypeus coarsely, rugulosely punctured; inner margins of eyes sinuate opposite the antennal fossæ; front and vertex polished and very minutely punctate; mesonotum polished, minutely punctate, impressed medially; notauli strongly impressed anteriorly, prescutum truncate and prominent; pronotum laterally polished, minutely punctate and somewhat rugulose; mesopleura polished, punctate below and anteriorly, a short, broad impression in the position of the sternauli, prepectal carina distinct and approximating the anterior edge of the pleura about half way up; metapleura sparsely punctured anteriorly, scabrous posteriorly; propodeal carinæ strong, basal median and lateral areas polished, all other areas, especially the apical ones, more or less roughly sculptured; first tergite about as wide apically as long, dorsal carinæ sharp and extending two-thirds of way to apex, polished between carinæ, otherwise punctate, especially laterally toward the apex; second tergite basally fine, rugulosely punctate, apically together with the remaining tergites minutely punctate, polished; ovipositor nearly perpendicular, barely extending above the dorsum; subdiscoidal vein of hind wing nearly interstitial with lower end of nervellus.

Black. with coxæ black, the front and middle ones pale at apex; mandibles at base and tegulæ pale; clypeus piceous at sides; abdomen more or less reddish on the sides apically; legs red with trochanters, front and middle femora apically, front and middle tibiæ and tarsi and hind tibiæ, except apices, paler; hind tibiæ at apex and hind tarsi fuscous; wings dusky, veins and stigma fuscous.

Male. Very like the female with a somewhat greater tendency to red on coxæ and abdomen, and with the antennæ paler beneath at base.

Host: Caliroa (Eriocampoides) cerasi L.

Type locality: North East, Pa.

Type: Cat. No. 19154, U. S. N. M.

Described from six females and four males (Quaintance No. 10934) taken by the writer August 26 and Sept. 5, 1914 on cherry trees badly infested by the pear slug, paratype *a* in the act of ovipositing in a nearly full-grown slug.

This species shows some variation in the color of the abdomen and coxæ and in the sculpture of the propodeal areas, pleuræ, and tergites, the color varying toward reddish-piceous and the sculpture showing more or less reduction on the parts mentioned. Paratype *b* exhibits some curious abnormal characters. In this specimen, a female, the prescutum is impressed anteriorly; the propodeum is very short, the basal areas being almost entirely obliterated; and the abdomen and legs are much shorter and stouter than in a normal specimen.

Genus Omorgus Foerster.

The following table includes those species of the genus the types of which are in the National Museum, and shows the affinities of the two new species described below.

Table of Species.

1. Posterior orbits sloping roundly inward behind the eyes.......... 2
   Posterior orbit straight and broad.................................. 6
2. Hind tibiæ white at base and in the middle with a black annulus near the base and another at the tip, the two connected below by a reddish stripe; hind basitarsus white at base, front and middle coxæ mostly reddish.......................................*phthorimaeæ* n. sp.
   Hind tibiæ reddish, sometimes infuscated near base and at apex.... 3
3. All coxæ red; scape beneath not pale; nervellus curved outward and not broken; fovea of second tergite much nearer to base than to spiracle.......................................*ferrugineipes* Ashm.
   Some or all of the coxæ black; fovea of second tergite but little nearer to base than to spiracle.. 4
4. Front and middle coxæ red, hind pair black; abdomen largely red, the first and second tergites tipped with red......*polychrosidis* Vier.
   All coxæ black; abdomen normally entirely black but sometimes reddish laterally toward apex, the first and second tergites always black.. 5
5. First tergite with a punctiform median impression somewhat in front of the spiracles, the segment in side view swelling rather abruptly from this point backward; ovipositor three-fifths as long as abdomen; hind trochanters black; wing veins fuscous; nervellus broken some distance above anal vein..........................*tortricidis* n. sp.
   First tergite without a median dorsal impression and gradually swollen apically; ovipositor half as long as abdomen; hind trochanters red; wing veins rufous; nervellus not broken, the trace of the subdiscoidal vein interstitial.......................................*nolæ* Ashm.
6. Hind and middle femora infuscated; scape not pale beneath; ovipositor three-fifths as long as abdomen; nervellus broken well above anal vein; large species, 8 mm.............................*epinotiæ* Vier.
   Hind and middle femora red; scape pale henath; ovipositor half as abdomen; nervellus straight subdiscoidal vein absent; small species, 4 mm...*nigricincta* Ashm.

Omorgus tortricidis n. sp.

Very closely allied to *nolæ* Ashm., but easily distinguished from that species by the characters given in the table to species.

Female. Length 5.5 mm.; ovipositor 2 mm. Head opaque granular and clothed with white pubescence; clypeus slightly elevated and with a shallow median impression, sparsely punctate; malar two-thirds as long

as basal width of mandibles; eyes very shallowly emarginate within; thorax opaque granular with scattered faint punctures; propodeum with strong carinæ, areas granular, the petiolar area transversely rugulose posteriorly and deeply excavated, areola barely angulate at the costulæ, basal middle area minute quadrate; areolet minute, with the outer cross vein bullated apically; nervellus distinctly broken some distance above anal vein; first tergite with a punctiform impression medially somewhat in front of the spiracles, the segment in side view swelling somewhat abruptly from this point backward.

Black with all coxæ and hind trochanters black, rest of legs, mandibles, and scape beneath rufo-testaceous, the front and middle legs somewhat paler, the hind tibiæ slightly infuscated apically and near the base; tegulæ yellowish; wings hyaline, veins and stigma fuscous.

Male. Length 5 mm. Differs from the female but very slightly.

Host: Polychrosis viteana.
Type locality: North East, Pa.
Type: Cat. No. 19155, U. S. N. M.

Described from a large series of both sexes reared by the author and his associates, Dwight Isely and E. R. Selkregg, from the above host under Quaintance No. 7895, during the season of 1914. This species has been previously recorded from the same host by Johnson and Hammar (Bur. Ent. Bul. 116, Part II, p. 48) as *Omorgus nolæ* Ashm. race.

The species varies more or less in nearly all the characters mentioned above, especially in venational and propodeal characters.

Omorgus ferrugineipes Ashm.

Three females and a male of this species are at hand reared by the writer from larvæ of *Polychrosis viteana* at North East, Pa., during the season of 1914 and under Quaintance No. 7996. These differ only in minute details from the unique type male. In the female the basal middle area of the propodeum is triangular but not petiolate behind as it is in type. The female is 5 mm. long and the ovipositor 1.25 mm.

Omorgus phthorimaeæ n. sp.

This species is very distinct from all the species included by the annulation of the hind tibiæ.

Female. Length 5 mm.; ovipositor 1.25 mm. In size, form, and sculpture very like *tortricidis*, described above, but differing from that species in the following particulars: clypeus not at all elevated and without shallow median impression; basal middle area of propodeum twice as wide at base as at apex and about two and one-half times as long as wide at apex, areola distinctly angulated at the costulæ, its bounding carinæ parallel for a short distance back of the costulæ; first tergite without median impression and in side view more evenly swelling posteriorly; nervellus less

Black with the coxæ and basal segment of posterior trochanters black; mandibles, palpi, trochanters, except as noted above, and tegulæ, whitish; posterior tibiæ white with the apex and an annulus near the base black, the two connected beneath by a reddish stripe; hind basitarsus white with apex black; middle tibiæ and tarsi with same arrangement of color as in hind legs but the black replaced by fuscous; all femora and front tibiæ of varying shades of rufous, the hind femora darkest and front tibiæ lightest.

Male. Differs from the female largely in the more contrasting colors of the legs, the lack of annulation on the middle tibiæ, and in having the basal middle area of the propodeum reduced to a triangle connected with the areola by a single short carina.

Host: Phthorimaea operculella.
Type locality: Pasadena, Calif.
Type: Cat. No. 19156, U. S. N. M.

Described from 4 females and 6 males reared from the above host by J. E. Graf in November, 1914, under Chittenden No. 2230^{03}.

This species varies in the following manner: one of the females has the sides of the abdomen beyond the second tergite largely red; the size and form of the basal middle propodeal ares varies in more or less reduction from the type; and some of the males show a rather distinct color pattern on the middle tibiæ.

Genus Xenoschesis Foerster.

The only species originally included in this genus and therefore the genotype is *Exetastes fulvipes* Grav., so placed by Jemiller (Ber. Ver. Augsberg, vol. 31, 1894, p. 147). The same species was selected by Kriechbaumer as the type of his genus *Glyptocentrus* and by Viereck as the type of *Polycinetis* (Foerster) Dalla Torre and *Polycinetus* Thomson. The genotype of *Polycinetis* Foerster as fixed by Woldstedt is *Notopygus resplendens* Holmgren. This species is shared as a genotype by *Prosmorus* Foerster, by fixation of Thomson, and, through its variety *polita* (Foerster) Kriechb., by *Eriglœa* Foerster, by fixation of Viereck. All of the above was pointed out by Viereck (U. S. N. M., Bul. 83).

Examination of specimens of the genotypes, *fulvipes* as determined by Schmiedeknecht and *resplendens* as determined by Roman, convinces me that they are congeneric. Therefore *Polycinetis* Foerster, *Polycinetus* Thomson, *Glyptocentrus* Kriechbaumer, *Prosmorus* Foerster, and *Eriglœa* Foerster are all synonyms of *Xenoschesis* Foerster.

As to the position of the genus, I prefer to place it with the Banchini, rather than with the Mesoleptini. It should be noted

that in dichotomy 6 in Ashmead's table the first character is useless since the areolet varies in respect to its presence or absence and length of the petiole. In the specimen of the genotype on which my study is based it is strongly petiolate. The possession or lack of a large petiolar area on the propodeum is a specific character. The genotype and *resplendens* lack the carinæ, while of the two American species described below one lacks them and the other has them well defined.

Xenoschesis slossonæ n. sp.

Agrees fairly well with the description of *limatus* (Cress.) but differs in having the propodeum carinate.

Female. Length 11 mm.; antennæ 10 mm.; ovipositor 0.5 mm. Clypeus a third as long as wide, broadly truncate, transversely ruguloso-punctate; face nearly twice as wide as long, densely, rather coarsely punctate, especially medially, slightly elevated above; malar space nearly half as long as basal width of mandibles; eyes sinuate within and parallel; flagellum 40-jointed, apically attenuate; front densely, minutely punctate; temples and vertex polished, impunctate; thorax and propodeum polished, rather densely, finely punctate, the latter short and gibbous above, with the lateral carinæ strong beyond the apical carina but subobsolete before, the apical carina weak, obsolete outside the lateral carinæ, areola punctiform, basal median area weakly defined and minute, petiolar area impunctate, spiracle oval; wings with areolet; nervellus broken slightly above middle; abdomen deeper than wide, subpolished, very minutely shagreened; first tergite about three-fifths as wide at apex as long, with two subcarinate dorsal ridges reaching to about two-thirds of the way to the apex and subtending a longitudinal depression, spiracles placed slightly before middle; second tergite about as long as basal width and subequal to third and fourth, others rapidly diminishing in length; hypopygium reaching slightly beyond apex of eighth tergite.

Black, with clypeus, mandibles, tegulæ, wing bases, and apices of sternites 1-3 white; palpi pale; antennæ brown, paler below, scape and pedicel piceous; legs testaceous except as follows: front and middle femora at apex, all tibiæ except apices, front and middle tarsal joints basally white; hind femora and tibiæ at apex and hind tarsi throughout black, the basitarsus slightly paler at base; hind calcaria dusky white; wings hyaline, stigma piceous, pale at base.

Type locality: Mt. Washington, N. H.

Other locality: Spruce Brook, Newfoundland.

Type: Cat. No. 19302, U. S. N. M.

Two females, the type collected by Mrs. Slosson and the paratype by E. M. Walker on July 21, 1914.

The paratype differs from the type in having the clypeus pale only at apex, antennæ black, flagellum 41-jointed, propodeum

with the carinæ weaker, the areola open behind, legs with the colors of the tibiæ, especially of the middle legs, more contrasting, tergites 1 and 2 relatively wider.

Xenoschensis gracilis n. sp.

Female. Length 11 mm.; antennæ 8.5 mm.; ovipositor barely exserted. Differs from *slossonæ*, described above as follows: clypeus somewhat shorter; face uniformly densely punctate; flagellum 33-jointed; propodeum not gibbous above, without carinæ except lateral carinæ at apex, smooth and impunctate, spiracle round; nervellus broken below the middle; abdomen wider than deep, polished, sparsely, weakly punctate; tergites relatively longer, the first about half as wide as long and without dorsal ridges though with a weak median furrow, spiracles at middle, fifth nearly as long as fourth; hypopygidium not reaching apex of eighth tergite.

Black; clypeus and mandibles whitish; tegulæ and wing bases pale fusco-testaceous; legs rather pale testaceous, hind femora apically and their tibiæ and tarsi throughout blackish; otherwise as in *slossonæ*.

Type locality: Franconia, N. H.

Other locality: Banff, Alberta, Canada.

Type: Cat. No. 19303, U. S. N. M.

Two specimens, the type collected by Mrs. Slosson and the paratype without other label than the number 458.

The paratype differs from the type in no way except that the areolet is somewhat petiolate.

Prosmoridea, new genus.

The sinking of *Prosmorus* (Foerster) Thomson into synonymy with *Xenoschesis* Foerster leaves *Prosmorus* (Foerster) Davis without a name. It is for this that I suggest the above name, designating as the genotype *Prosmorus elongatus* Davis. It differs from *Xenoschesis* in having the propodeum completely areolated, the apical carina tuberculate above on each side, in lacking the emargination of the eighth tergite in the female, and in having the sheaths of the ovipositor very broad. It resembles in habitus much more closely *Cidaphrurus* and *Banchus* and should probably be placed with the Banchini rather than with the Mesoleptini. From the two banchine genera mentioned it differs in the complete areolation of the propodeum, the strong prepectal carina, the small oval propodeal spiracle, the petiolate first tergite with its spiracle at about the middle, the position of the fracture of the nervellus which is at or below the middle, the simple claws in the female, and from *Cidaphrurus* by lacking the scutellar thorn. In Foerster's table it runs to *Banchus*.

Bassus carpocapsæ Cush.

Since the writing of the description of this species, when only the female was known, a single male has been reared by the author from codling moth material collected in 1913 at Vienna, Va. This differs from the female in having the testaceous color of the head confined to the orbits, malar space, clypeus, and mouth, being practically obsolete on the anterior orbits; only the second and third tergites are rufous and the latter is somewhat infuscated at the apex; the hind coxæ are more largely black and the hind femora infuscated. This male is in the National Museum collection and is indicated by a red label marked: ♂ Cush. det.

THE GENUS SECODELLA IN NORTH AMERICA.

By J. C. Crawford.

This eulophid genus which has the hairs of the fore wings in part arranged in characteristic rows is also peculiar in having the under side of the fore wings furnished with a row of long hairs situated on the disc of the wing just back of the central portion of the marginal vein. This latter character I have observed in no other genus.

KEY TO THE FEMALES

1. First joint of funicle not distinctly longer than pedicel 2
   First joint of funicle distinctly longer than pedicle 3
2. Larger (2 mm.) greenish, sculpture of thorax strong . . . . *cushmani* n. sp.
   Smaller (1.25 mm.) purplish, sculpture of thorax weak . *acrobasis* n. sp.
3. Last joint of club without an apical spicule . . . . *rugosus* n. sp.
   Last joint of club with an apical spicule 4
4. First joint of funicle longer than second, about twice as long as pedicel. *viridis* n. sp.
   First joint of funicle not longer than second, about one and one-half times as long as the pedicel . . . . *argyresthia* Cwfd.

Secodella cushmani n. sp.

Female. Length about 2 mm. Dark green with bluish reflections; first joint of funicle hardly longer than pedicle, joints of funicle successively decreasing in length, the fourth subquadrate; club about as long as last two joints of funicle united; mesothorax strongly subreticulate, much more finely so on parapsidal areas; propodeum short; abdomen more bluish than head and thorax; wings hyaline with three lines of hairs from stigmal knob, one directed basad and forming boundary of area without hairs, two directed apicad; one line of hairs along posterior margin of wing and one somewhat in front of this and another line reaching apex of wing

but originating on disk of wing; under side of fore wings with a row of about 7 long hairs near marginal vein; legs metallic, tarsi whitish.

Male. Length about 1 mm. Similar to the female except in secondary sexual characters.

Type locality: North East, Pennsylvania.
Host: Polychrosis viteana.
Type: Cat. No. 19653 U. S. M. N.
Described from seven specimens under Bureau of Entomology, Quaintance No. 10905, R. A. Cushman, collector.

Secodella acrobasis n. sp.

Female. Length about 1.25 mm. Violaceous with some bluish reflections; first joint of funicle no longer than pedicel, all joints of the funicle short, hardly longer than broad; club about as long as the last three joints of the funicle combined; mesonotum finely weakly reticulated; wings hyaline with three lines of hairs from stigmal knob as in previous species; basal half of the area between the two rows directed apicad, without bristles; two rows of hairs near posterior margin, one discal row; under side of fore wings with a row of three or four long hairs posteriad of middle of marginal vein.

Male. Length about 0.8 mm. Similar to female excepting secondary sexual characters.

Habitat: Monticello, Florida.
Host: Acrobasis nebulella.
Type: Cat. No. 19654, U. S. N. M.
Described from one female and nine males under Bureau of Entomology Quaintance No. 10540. Reared by J. B. Gill from over-wintering larvæ of the host.

Secodella rugosus n. sp.

Female. Length about 3.25 mm. Dark brown with propodeum and base of abdomen more distinctly greenish; head and thorax, especially the parapsidal areas and scutellum, more purplish; first joint of funicle much longer than the pedicel and much longer than the second joint, the latter about as long as pedicel, third and fourth joints of the funicle successively shorter, the fourth subquadrate; club about as long as the third and fourth joints of the funicle combined, the last joint without any sign of spicule; head and thorax coarsely reticulated, the reticulations on the axillæ, parapsidal areas and scutellum finer; propodeum long, with a median and lateral carinæ and in addition irregularly rugulose; laterad of the spiracles with thimblelike punctures; wings hyaline with the same number of rows of bristles as in the previous species but the discal row basally curved toward the rear of wing and meeting at its base the row next caudad of it; rows of long hairs on under side of wing in rear of marginal vein, numbering ten; legs metallic, apices of the tibiæ testaceous, tarsi whitish.

Type locality: Oswego, N. Y.

Type: Cat. No. 19655 U. S. N. M.

Described from three specimens, one of the paratypes having seven hairs in the row on the under side of wing the other with six.

Secodella viridis n. sp.

Female. Length about 3 mm. Bright green; first joint of funicle about twice as long as pedicel, the following joints successively decreasing in length, the fourth about as long as the pedicel; club about as long as last two joints of funicle combined; head and thorax very finely reticulated; propodeum short, with a median carina; wings hyaline, with the three usual rows of hairs from stigmal knob; a short discal row of hairs joins the posterior of the two apically directed rows from stigmal knob at about its middle; two rows of hairs near posterior margin of wing, three short discal rows; the surface of the wing along each side of all rows of hair is without hairs; row of hairs on underside of wing near marginal vein numbering about four; legs brown, femora with greenish tinge; tarsi whitish.

Male. Length about 2 mm. Similar to the female.

Type: Cat. No. 19656, U. S. N. M.

Described from eight specimens under Bureau of Entomology No. 2610, reared January 19 and 22, February 8, 11, 13, 19 and 24, 1886; the note for these specimens cannot be located at present so type locality and host cannot be given.

Under the heading of "Notes and Exhibition of Specimens," the following were presented:

A NEW SPECIES OF STENARES.

(*Neuroptera, Myrmeleonidæ.*)

By Nathan Banks.

Stenares completus n. sp.

Face pale yellowish, mandibles, palpi, and antennæ black; vertex gray, with a median black line, widening into a triangle behind, and with [illegible] ten or twelve small black spots each side; pronotum gray, with a broad [illegible] median stripe, the lateral margins black, between them and the [illegible] stripe is a black dot each side, some gray hair, but black on lower sides [illegible] thorax gray, lined with black, but densely long haired, the hairs [illegible] grayish white, pleura still more densely gray haired. Abdomen [illegible] black, with short white hair, each segment with one or two small [illegible] yellowish spots each side above. Legs black. Eyes rather less [illegible] in front; the last joint of palpi is one and a half times [illegible] vertex very high; pronotum broad, not [illegible] Fore wings scarcely marked; an apical costal streak

and a fainter one below it, a faint prestigmal mark, not distinct, between median and radial sector; the space between median and cubitus is dark, except for three interruptions; nearly all other veins, especially the cross-veins, have little black spots at intersections and also between intersections. The hind wings are marked very similar to those of *S. irroratus* but the spot near the cubital fork is larger and reaches up to the subcosta; behind the median band there is one large spot on the margin; the stigmal band is narrow on the costal part, and then much broader and reaches obliquely to the hind margin; the apical spots as in *S. irroratus;* between the stigmal and median bands there is near the hind margin, a large oblique mark, its upper point directed toward the median band. In fore wings the costals are all crossed, in the hind wings about six near the base are crossed. Expanse 130 mm.

From Abyssinia, D. Daona. It differs from *S. irroratus* (of which I have seen the type) in the spotted vertex, the less marked fore wing, and more heavily marked hind wing, and presence of large spot between median and stigmal bands.

A NEW SPECIES OF MYCETAULUS

(*Diptera, Sepsidæ.*)

BY NATHAN BANKS.

Mycetaulus pulchellus n. sp.

Head yellowish or rufous, ocellar area black; thorax above and below wholly yellow or pale reddish yellow; abdomen dark brown or black, shining; legs pale yellowish, unmarked, except that the hind tibiæ are rather infuscated on the basal half. Abdomen with fine, short, dark hair mostly on the base; head and thorax with long black bristles, six across vertex, and two proclinate ocellar bristles; thorax with about fourteen, and four on edge of the scutellum, the median pair very long. Wings hyaline, veins brownish, a black spot over the ends of the second and third longitudinal veins; posterior cross vein about two-thirds its length from the margin, and one and a half its length (or more) from the anterior cross-vein. Halteres white. Abdomen short and broad, convex, acute at tip.

Length of body 3 mm., of wing 3 mm.

From Falls Church, Va., September 28, and Glencarlyn, Va., October 7. But one species has been described from North America, *M. longipennis* Loew from British America; it has basal dark spot on the thorax, and the metanotum and pectus dark, and the costal cell is also darkened. The genus, though resembling *Sepsis* and *Nemopoda* differs in lacking auxilliary vein, or rather the auxilliary is united to the first vein. It differs in appearance from *Piophila*, and in that the fourth vein is not bent up at anterior cross-vein.

MISCELLANEOUS NOTES.

By Nathan Banks.

1. *Andrena carlini* Ckll. Sucking Sap.

Mr. Banks exhibited specimens of this species which he found sucking the sap from maple stumps at Falls Church, Va., on the 14th of March and later dates. So intent or so intoxicated were they that they did not fly on repeated sweeping of the net in catching the flies, and a number of specimens were taken up with the fingers. All were males.

2. *Syrphus fisheri* Walton, in Virginia.

The author exhibited a specimen of this fly, described from Pennsylvania, which he had taken at Glencarlyn, Va., 14 July, and so determined by Walton.

3. Apterous Females of a Caddice-fly.

Specimens of *Philopotamus distinctus* Hag. were exhibited, mostly taken by Mr. Shannon near Plummer's Island, Md. The male was normally winged, but the females had the merest rudiments of wings. Since winged females of this species are well known, Mr. Banks considered that this apterism was due to some local cause, possibly operative only the present season.

4. Color in Hibernating *Chrysopa interrupta* Sch.

The author showed specimens of this rather uncommon chrysopid taken during the past winter by Mr. McAtee at Mt. Vernon, Va. The specimens were found in dry leaves clinging to a fallen tree. Many of the specimens were unmarked, but a number had a more or less extensive pattern of red markings on the head and thorax, possibly due to frost; one had a reddish head. No similar variation has been recorded in other chrysopids, and hibernation was previously unknown in this species.

5. The Genus *Ceratoacarus* Ewing (Acarina).

In the Ent. Tijdskrift for 1914, p. 186–187 Dr. Trägardh calls attention to the fact that this genus is a synonym of *Labidostomma*, a fact that I recognized at once and wrote Dr. Ewing. Dr. Tragardh takes this as an occasion to criticise American Acarologists for not knowing the literature of this group. Am I to judge all European Acarologists by the mistakes of a few?

I am familiar with all the literature cited by Trägardh, and it is really he who does not know the literature. For he spells the genus *Labidostoma* several times, when it originally was spelled *Labidostomma*, and moreover he states that this record

of Dr. Ewing's is the first record of the genus in America. Such is not so. Stoll, in the Acari of the Biol. Cent. Amer., published over twenty years ago, describes a species from Guatemala (*Nicoletiella neotropica*).

PUPA OF BRACHYPALPUS FRONTOSUS Lw.

By H. L. Parker,
Bureau oj Entomology.

A puparium of this rather common syrphid fly was found by the writer February 18 last on top of the mountain range lying south of Hagerstown, Md. It was under a growth of the moss *Polytrichium ohioensis* and was placed in a tin box and kept in a moist condition indoors. An adult fly emerged March 15, which was determined by Mr. Walton as *Brachypalpus frontosus* Loew. The puparium proper is 11 mm. long, of the usual syrphid shape, namely that of a pear flattened on one side, without lateral appendages and brownish in color. The anal end is produced in a distinct cauda about 4 mm. in length, bearing at its base three or four pairs of filamentous lateral appendages.

CAPTURES OF THE SYRPHID FLY, MERAPIOIDUS VILLOSUS BIGOT.

By R. C. Shannon,
Bureau oj Entomology.

This fly has been recorded but three times, so far as the writer is aware, and recent captures by him and others may be of interest. Six specimens were taken at sap of sugar maple March 13 and 14, 1915, at Dead Run, Fairfax Co., Va. On the latter date, Mr. McAtee also took a specimen on a maple bud on Plummer's Island, Md., and Mr. Banks on the same day took two specimens at sap of swamp maple at Falls Church, Va. Four days later Mr. Greene and the writer each took a specimen at Dead Run, one at sap and the other resting on the trunk of a beech tree.

Bigot described this genus and species (Bull. Soc. Ent. de France, 1879, p. L) from Georgia. Williston recorded a specimen from Georgia (North American Syrphidæ, 1886, p. 244). This specimen and another collected by Morrison in North Carolina were the only examples in the National Collection. Metcalf (Syrphidæ of Ohio, Ohio State Univ. Bull., Vol. XVII, No. 31, p. 96. 1913) records three specimens from Ohio, two of them taken April

1 on *Salix* at Lakeville. The unusually early occurrence of this syrphid (before the appearance of the spring flowers) is probably the reason that it has been so seldom taken.

AN UNUSUAL COLOR IN A HORNET'S NEST.

By L. O. Howard.

Recently the Bureau of Entomology has received a specimen of the nest of the bald-faced hornet (*Vespula maculata* Linnaeus) from Mr. Arthur D. Addison of Washington, D. C. This nest was collected between Massachusetts and Cathedral Avenues and is remarkable inasmuch as it is irregularly striped with vivid blue. The blue stripes seem to be precisely of the same texture as the mottled gray covering of the nest. It is presumed that the blue stripes in this nest were made from a kind of building paper which workmen commonly use in the buildings in the suburbs. Mr. Addison notes that this nest was far removed from any building and it is doubtful where the wasps could have found access to such paper.

In discussing this paper Mr. Crawford stated that it was not at all uncommon for nests of this hornet to have stripes in them. One very often finds nests bearing a few very small white stripes evidently made when the wasps discover a supply of white paper.

The National Museum has on exhibit a very fine example of colored nest from Barto, Pennsylvania. In this example there is so much red that the nest may better be described as being red with grayish stripes. In this, the color appears to be due to the wasps having used cedar for the manufacture of their paper.

In the opinion of Mr. Crawford the striping is due to the concentration of work by the wasps along a narrow stripe, then their moving to another portion of the nest to work while allowing the first part to dry, and also to the well known habit of the social Hymenoptera when discovering a ready supply of building material or food to concentrate their efforts to carry it away. In this connection he stated that some accurate observations on both actual work of building and on securing the building material are greatly desired as our knowledge of these is very limited.

SOME GENERIC CORRECTIONS IN THE OPHIONINÆ.

By S. A. Rohwer, A. B. Gahan and R. A. Cushman,
U. S. Bureau of Entomology.

Tribe Anomalini = (Nototrachini)

Genus **Anomalon** Panzer.

Anomalon Panzer. 1805, Fauna Ins. German., H. 94, p. 15.

Type.—*Anomalon cruentatus* Panzer. Monobasic.

Syn. *Trachynotus* Gravenhorst. 1829, Ichnn. Eur., vol.3, p. 713 (nec Latreille).

Type.—*Ophion foliator* Fabricus. Monobasic.

Syn. *Nototrachys* Marshall. 1872 Trans. Ent. Soc. London, p. 260, new name for *Trachynotus* Gravenhorst.

Syn. *Ochlerus* Gistel. 1848, Naturg. Thierry, p. xl, new name for *Trachynotus* Gravenhorst.

When Panzer proposed *Anomalon cruentatus* in 1805 he established *Anomalon* as a monobasic genus. *Anomalon cruentatus* Panzer has remained in the literature as an unknown species. The only note which indicates its identity is that of Gravenhorst, 1829, Ichnn. Eur., vol. 3, p. 720, where under the discussion of *Trachynotus foliator* he states that he has received specimens labelled *Anomalon cruentatus* Panzer and that this is a black variety of *foliator* but he considers that *cruentatus* of Panzer is different from *foliator* because the ovipositor is longer than in the specimens of *foliator* which he had. By consulting the figure of *cruentatus* given by Panzer we can say that this species undoubtedly belongs to the genus *Nototrachys*, and from the specimens and literature available we are inclined to believe that *cruentatus* of Panzer is the same as or extremely closely allied to *foliator* Fabricius.

This information makes it necessary to consider *Nototrachys* and its various accepted synonyms as synonymous with *Anomalon* Panzer, and to change the tribe Nototrachini to Anomalini.

Therionini = (Anomalini Ashmead et Auctorum)

Genus **Therion** Curtis.

Therion Curtis. 1839, Brit. Ent., vol. 16, p. 736.

Type.—*Ichneumon circumflexus* Linnæus. Original designation.

Syn. *Exochilum* Wesmael. (1844) 1850, Bull. Acad. Sci. Belgium, vol. 16, pt. 2, p. 119 and 122.

Type.—*Ichneumon circumflexus* Linnæus. Monobasic.

Inasmuch as Curtis designated the type of *Therion* as *circumflexus* Linnáeus the name *Exochilum* Wesmael which was proposed for the same species was unnecessary and as Curtis' genus antedates Wesmael's by ten years, *Exochilum* of Wesmael becomes a synonym of *Therion* Curtis, the two genera being isogenotypic.

Since *Anomalon* has to be used for *Nototrachys* (see above), the Tribe Anomalini of Ashmead and authors should be known under a name derived from that of the oldest genus which it contains. This is *Therion*, therefore the Anomalini of Ashmead and authors should be designated as Therionini.

Genus **Erigorgus** Förster.

Erigorgus Förster. 1868. Verh. Naturhist. Ver. Preuss. Rheinland, vol. 25, p. 146.

Type.—*Anomalon* (*Erigorgus*) *carinatum* Brischke. Monobasic by Brischke in 1880.

Syn. *Barylypa* Forster. 1868. Verh. Naturhist. Ver. Preuss. Rheinland, vol. 25, p. 146.

Type.—*Anomalon* (*Barylypa*) *genalis*. Thomson. Included by Thomson in 1892 and designated by Viereck in 1911.

According to Szepligeti and Schmiedeknecht the types of the above mentioned genera are congeneric. It is therefore necessary to sink *Barylypa* of Förster to *Erigorgus*, as *Erigorgus* has line precedence.

The *Erigorgus* of Schmiedeknecht, Opusc. Ichnn., vol. 4, 1908, p. 1484, is without a name but inasmuch as we are not sufficiently familiar with this genus we hesitate to propose a name for it especially as Szepligetti considers this group to be congeneric with the type of *Paranomalon* Viereck.

Two Hundred and Eighty-Sixth Meeting,

May 6, 1915.

The 286th regular meeting of the Society was entertained by Mr. E. A. Schwarz at the Sængerbund Hall, May 6, 1915. The following were present: Messrs. Baker, Barber, Böving, Burgess, Caudell, Craighead, Crawford, Duckett, Ely, Gahan, Greene, Heinrich, Howard, Jennings, Knab, Kotinsky, Middleton, Pierce, Rohwer, Rust, Sanford, Sasscer, Schwarz, Shannon, Turner, Walton, Wood, members, and Messrs. J. W. Davis, Dr. Güdmund Hatt, W. C. O'Kane and L. H. Worthley, visitors.

At the close of the regular program Mr. Burgess, being called upon told in detail of the methods used and the success attained in the colonization of the egg-parasite of the gypsy-moth, *Anastatus bifasciatus*, in Massachusetts.

Mr. L. H. Worthley and Mr. I. W. Davis, visitors, were in turn called upon by the President and responded briefly.

THE USES OF CERTAIN WEEVILS AND WEEVIL PRODUCTS IN FOOD AND MEDICINE.

BY W. DWIGHT PIERCE.

Large quantities of pupal cocoons of a weevil were recently received by the Bureau of Chemistry from the American Consul at Constantinople under the name of trehala manna, an edible substance. Although there is some little literature on the subject it is mostly very inaccessible and practically unknown to American entomologists. A complete bibliography of the chemical phases of trehala has been prepared in the Bureau of Chemistry and was very kindly loaned the writer by Mr. C. S. Hudson.

It is not common for an insect to produce a substance which is edible for man, and that a weevil should be the maker is a matter of especial interest.

The first reference in literature properly classifying the maker of this substance is contained in a note by Guibourt (Revue et Magasin de Zoologie, 1858, ser. 2, vol. 10, p. 276) entitled "Notice sur une matière pharmaceutique nommée la Tréhala, produite par un Insecte de la famille des Charançons." He states that the cocoon is used for food in the Orient as commonly as salep and tapioca are used in France. His material was received from Roumelia and probably originated in Syria. Guibourt names the producer of these amylaceous cocoons *Larinus nidificans*, but does not supply any further description.

About the same time as the publication of Guibourt's note, M. Berthelot made a chemical study of the product and published an article entitled "Sur le tréhalose, nouvelle espèce de sucre" (Comptes Rendus de l'Academie des Sciences, vol. 46, June 1858, pp. 1276–1279). This substance trehalose is analogous to cane sugar, with the formula $C_{12}H_{22}O_{11}$ as indicated by modern chemistry. At ordinary temperatures it retains two molecules of water of crystallization. The properties are quite fully discussed.

It is interesting to note that trehalose was first obtained from the ergot of rye, that it is derived from many species of mushrooms, from *Aspergillus niger*, and also from the resurrection plant (*Selaginella lepidophylla*).

A very full discussion by Daniel Hanbury followed these preliminary notes in an article entitled "Note on two insect-products from Persia" (Journal of the Proceedings of the Linnean Society, Zoology, vol. 3, 1859, pp. 178–183, figs. 1–3). Hanbury carefully reviews the earlier literature on tréhala, which he also calls tricala, citing the early Persian names for it (Shakar-elma-ascher) and stating that the first reference to the substance was made by Father Ange in his "Pharmacopœa Persica" in 1681. He describes the cocoons as ovoid or globular, about ¾ of an inch long; their inner surface composed of a smooth, hard, dusky layer, external to which is a thick, rough, tuberculated coating of a greyish-white color and earthy appearance. They are made on the stems of *Echinops* and sometimes contain spiny portions of the leaves. The maker of the cocoons seen by him is *Larinus maculatus* Faldermann a species closely related to *nidificans*, as later defined by Capiomont and Leprieur. *Larinus maculatus* occurs in European Turkey, Caucasus, Persia, Barbary and Portugal.

Hanbury cites Dr. Honigberger as saying that these insect nests are imported into Lahore from Hindustan, and that trehala is abundant in the shops of the Jew drug-dealers of Constantinople, where it is frequently used by the Arab and Turkish physicians in the form of a decoction, which is regarded by them as of peculiar efficiency in diseases of the respiratory organs.

In the above cited work Hanbury also calls attention to the production of a saccharine substance resembling dark honey made by the punctures of *Larinus mellificus* Jekel, in the stems of *Echinops* in Persia. Dr. Heyden in 1880 (Le Naturaliste, vol. 2, 237) quotes *Larinus mellificus* as a synonym of *L. nidificans* Guibourt. It would therefore seem that the adult in puncturing *Echinops* causes a flow of honey, while the larva after feeding to maturity constructs a saccharine cocoon.

In the same year Gervais and van Beneden in their Zoologie Medicale (Paris, 1859, pp. 311–313) give more details as to the uses of trehala. To obtain the decoction used in diseases of the respiratory organs, especially bronchial catarrh, a litre of boiling water is poured over about 15 grams of cocoons, this is stirred for about a quarter of an hour and then boiled, and the decoction is drunk by the patient without being filtered. They refer to the maker of the cocoons as *Larinus syriacus* Chevrolat found on *Onopordon* on the desert between Aleppo and Bagdad. The cocoons must be collected before the weevils emerge and it is thought probable that the latter have a part in the medicinal action of the trehala.

Various other short articles bearing upon the subject have been published but all are cited in the works here mentioned.

In their monograph of *Larinus*, Capiomont et Leprieur (Ann. Soc. Ent. France, ser. 5, vol, 4, 1874, p. 65) give a full description of *Larinus nidificans* Guibourt. They cite its origin as Syria and Persia. The cocoon is said to taste sweet and to swell in water without completely dissolving even after long boiling. It contains 66 per cent of a substance similar to sago, a little gum, a small amount of inorganic mineral matter, and 28 per cent of the sugar called trehalose. The natives use it in a decoction against bronchial catarrh and as a food like tapioca. The sago-like substance has been chemically named trehalum. It is a tasteless carbohydrate, with the formula $C_{24}H_{42}O_{21}$.

A very concise summary is also given by Bargagli (Rassegna Biologica Rincofori Europei, 1883–7, pp. 110, 111) of the habits

Fig. 1. Larinus nidificans. Pupal cells.

of the weevil and of the nature of its cocoon. Bargagli cites the names of the substance of the cocoons as thrane, thrale, trehala, tricara and tricala. The cocoons are gathered before the weevils mature.

The specimens exhibited are the *Larinus nidificans* Guibourt as defined by Capiomont and Leprieur. Fragments of the plant were submitted to Mr. Paul C. Standley and determined by him as a species of *Echinops*.

The genus *Larinus* is confined in its habits to breeding on Compositæ related to the thistle. The larvæ usually feed at the base of the flower head and then construct a cocoon (fig. 1) This cocoon is made by abdominal excretion, and causes the larva to diminish considerably in size during its construction.

Gervais and Van Beneden as well as other authors quote Gerbi's reference to the use of the larvæ of *Rhinocyllus antiodontalgicus*

Gerbi, a species nearly related to *Larinus*, in certain parts of France, for toothache and inflammation of the gums. Merely touching the insect to the aching part was claimed to give relief. This antiodontalgic property is also ascribed by Gerbi to various other weevils, such as *Rhynchites bacchus* and *R. betuleti*, and *Larinus jaceae*.

Incidentally it may be stated that various authors cite the fact that the larvæ of the palm weevil (*Rhynchophorus palmarum* Linnaeus) are considered a very delicious food by the natives in Central America. The larvæ are roasted and when properly cooked are esteemed rich and delicate eating. There are also suggestions in the literature as to the edibility of *Calandra chinensis*.

THE SECRETIONS EMPLOYED BY RHYNCHOPHOROUS LARVÆ IN COCOON-MAKING.

By Frederick Knab, *Bureau of Entomology*.

The question of the source of the substance constituting the bulky cocoons of *Larinus* shown by Mr. Pierce is an interesting one. There is good reason to believe that it is at least for the greater part a product of the malpighian tubes, and therefore voided through the anus. Moreover, it would seem that such is the origin generally of the cocoons of very diverse structure and texture constructed by the larvæ of many genera of Rhynchophora at the time of pupation. The viscous secretion covering the bodies of certain externally feeding weevil larvæ is undoubtedly from the same source.

In the discussions of the biology of certain weevils one frequently finds the statement that the larva "spins" the cocoon, the impression conveyed being that the process is analogous to the cocoon spinning of lepidopterous larvæ. Indeed, labial spinnerets occur in some weevil larvæ,[1] and it can not be altogether denied that some of them "spin" in the restricted sense; but this organ is very minute, so that its rôle must be a very subordinate one. It seems probable that the rectal glands contribute also to the cocoon-forming substance, and possibly there is still another contributing source, the surface glands distributed over the body. Thus, the cocoon may be composed of material from four distinct sources, just as Dr. Böving has demonstrated in such an excellent manner for *Donacia*.[2]

[1] Henneguy, L. F. Les Insectes, p. 462. 1904.

[2] Böving, Adam Giede, Natural history of the larvæ of Donaciinae. Internat. Rev. d. gesamten Hydrobiol. u. Hydrogr., vol. 3, Biol. Suppl. 1, 108 p., 7 pls. 1910.

My interest in the subject was awakened in 1902, by finding the larvæ of *Cœlogaster lituratus* Dietz, which are external feeders and cover themselves with their own dung in the manner of the larvæ of *Lema*. It was found that these larvæ of *Cœlogaster* were completely enveloped in a transparent viscous coating. Later, opportunity was found to investigate the production of such a secretion in the larva of *Hypera punctata*,[1] conflicting statements having been found in the literature. Thus De Geer[2] and Lacordaire,[3] discussing the larva of *Hypera*, state that it is covered with a viscous substance which aids it in locomotion and enables it to cling to its food-plant. Goureau could perceive no such viscous substance and asserted that the larva moved and maintained its position solely by means of the series of ventral tubercles. He believes that the open-meshed cocoon was spun as in lepidopterous larvæ.[4]

Perris, in his earlier writings on the subject, takes issue with these authors and asserts that in *Cionus*[5] and *Hypera*[6] the viscous substance is secreted from a papilla situated basally on the upper side of the twelfth body-segment and that the substance is carried forward by peristaltic movements of the body. This papilla is stated to be ordinarily hidden, but protrusile. Perris states that the cocoons are formed of this same viscous substance, drawn from its source by the aid of the mandibles and palpi. We find the positive assertion that the threads of the open-meshed cocoons of *Hypera* do not come from spinnerets near the mouth, but are drawn from the gland at the base of the twelfth segment. The statement of Perris, that the viscous secretion of the larva of *Hypera* proceeds from a tubercle on the twelfth body-segment, appears to have been very widely accepted and is repeated even in works of recent date. We find it, among others, with Taschenberg,[7] Bargagli[8] and Lumardoni.[9] But the impression gained is that these statements are not based upon original observation.

---

[1] The name *Hypera* is used here in the broader sense as synonymous with *Phytonomus*, over which latter it has priority.

[2] De Geer, Carl. Mémoires pour servir a l'histoire des insectes, vol. 5, p. 233. 1775.

[3] Lacordaire, J. Th. Introduction à l'Entomologie, vol. 1, p. 103. 1834.

[4] Goureau. Note pour servir à l'histoire du Phytonomus rumicis. Ann. Soc. Ent. France, ser. 2, vol. 2, p. 49–59. 1844.

[5] Perris, Edouard. Notes pour servir à l'histoire des Cionus. Ann. Soc. Linn. Lyon, vol. 2, p. 25–29. 1850.

[6] Perris, Edouard. Notes pour servir à l'histoire des Phytonomus et des Phytobius. Mém. Acad. Sc. Lyon, ser. 2, vol. 1, p. 93–106. 1851.

[7] Taschenberg. Praktische Insekten-Kunde, part 2, p. 123. 1879.

[8] Bargagli, Piero. Rasegna biologica di rhincofori europei. Bull. Soc. Ent. Ital., vol. 15, p. 319. 1883; vol. 16, p. 165. 1884.

[9] Lumardoni, A. Gli Insetti nocivi, vol. 1, p. 339. 1889.

Careful and repeated examination of larvæ of *Hypera punctata* convinced me that no such tubercle exists. Furthermore, larvæ were observed at various stages in the process of constructing their cocoons. It could be readily perceived that the thick irregular threads of viscous substance were drawn forth from the anus by means of the mouth-parts, and there could be no doubt as to the origin of at least the bulk of the material. Finally, dissections of *Hypera* larvæ showed an enormous development of the malpighian tubes; just what one could expect to find under the circumstances.

Perris evidently could not afterward verify the presence of the tubercle he had indicated in his earlier writings as the source of the secretion. In his great work on the larvæ of the Coleoptera,[1] which I have only recently had opportunity to examine, we not only find no mention of the tubercle, but in connection with several genera the positive statement that the secretion in question issues from the anus. Under *Hypera* (p. 385) we find the following: "They have the faculty of secreting from the anus a mucilaginous and viscous substance which spreads over the body in a very thin layer, principally over the ventral surface, and effectively aids them in maintaining their position. This same substance, wholly insoluble in water, as it should be, also assists them when they are about to transform to attach themselves to some point, either upon the food-plant itself or to any other, and finally they employ it to surround themselves with an elegant irregularly reticulate cocoon constructed by drawing forth the mucilage in threads by the aid of their mandibles and palpi and the movements of the body."

A statement of the same import occurs under the genus *Cionus* (p. 404–405): "They are habitually covered with a mucilaginous substance which escapes from the anus and is spread over the body by the peristaltic movements of the segments. At last they produce this substance in larger quantity, they allow it to harden, and thus they find themselves enclosed in a parchment-like cocoon which remains attached to the leaves, stalks or flowers."

Perris observed that even the internally feeding forms construct their cocoons by the same process. Under *Orchestes* (p. 402), whose larvæ are leaf-miners, we read: "At the last the larva surrounds itself with a cocoon which it forms with the aid of its mandibles and palpi from a mucilaginous substance which issues from the anus."

J. A. Osborne, an English observer, makes a brief corroborative statement. "The spinneret of the larva of *H. rumicis* is anal."[2]

[1] Perris, Edouard. Larves de Coléoptères. Paris, 1877.

[2] Osborne, J. A. On the cocoons formed by Hypera rumicis and its parasites, and Cionus scrophulariæ. Ent. Mo. Mag., vol. 16, p. 16–18.

C. V. Riley took exception to this statement and in contradiction says: "*Ph. punctatus* spins with its mouth, bracing itself against the part of the cocoon already formed while constructing the remainder. The silk issues from the spinneret in a very perceptibly liquid condition, but soon hardens, . . ." The employment of the viscous secretion from the anus to aid in locomotion is indicated on the preceding page.[1]

This observation by Riley, of the employment of the labial spinneret by the larva of *Hypera* in the construction of its cocoon, is partly corroborated in a recent paper by Folsom, who says: "The actual spinning is done with the mouth. . . . At intervals the supply of silk fluid in the mouth gives out; then the larva reaches back to the end of the abdomen and by an assiduous process of nibbling secures a new supply of silk fluid from the rectum, and resumes its spinning. This performance always occurs, and can be observed easily with a hand lens in the earlier stages of cocoon-spinning. Riley and J. A. Osborne were each partly correct in their accounts of the spinning."[2]

These statements, finally, are again opposed by C. N. Ainslie, who is quoted by F. M. Webster as follows: "Instead of spinning the silk from a gland that opened into its mouth, as was supposed, the fluid from which the silk is made is taken into the mouth apparently from a gland in the caudal segment. The larva applied its mouth to an opening or gland close to the anus."[3]

In conclusion may be mentioned an observation by Montandon, recorded by Bourgeois, that the larva of *Herpes porcellus* (Byrsopidæ) makes a reticulate cocoon similar to that of *Hypera* and composed of an anal secretion.[4]

The statements by Riley and Folsom, that the larva of *Hypera* spins from a labial spinneret, should not be denied altogether. But it appears certain to me that the bulk of the cocoon-forming substance is produced from the anus and primarily from the malpighian tubes. Perhaps the lesser supply from the silk glands has some special function. Not improbably it is applied as a coating over the coarser threads from the rectum, to make them insoluble to water. I have noted that the larva passes its mouth along the threads after they have been drawn out and put in place, and it

---

[1] Riley, C. V. Report of the Entomologist. Rept. Com. Agric. for 1881 and 1882, p. 174, 175. 1882.

[2] Folsom, J. W. The insect pests of clover and alfalfa. Univ. Illinois Agr. Exp. Stat. Bull. 134, p. 161. 1909.

[3] Webster, F. M. Preliminary report on the alfalfa weevil. U. S. Dept. Agric., Bur. Ent., Bull. 112. 1912. (P. 23, quotes C. N. Ainslie.)

[4] Bourgeois, J. Contribution à l'étude des métamorphoses de l'*Herpes porcellus* Lacord. Bull. Soc. Ent. France, 1906, p. 94–95.

seems plausible that at this time the silky coating is being applied. An investigation of the character of the different secretions would easily decide this question.

NOTES ON NORTH AMERICAN CHLOROPIDÆ (DIPTERA).

J. R. MALLOCH,
Illinois State Laboratory of Natural History.

In a paper which presented a generic synopsis of the family Chloropidæ[1] I described an insect which at the time I considered as a possible variety of *Chloropisca glabra* Meigen, giving it the varietal name *clypeata*. Since writing that paper I have obtained a number of specimens of *clypeata* from different localities, and an examination of these has convinced me that they belong to a species that is distinct from *glabra; clypeata* should therefore be used in a specific instead of a varietal sense.

The species is distinguished from *glabra* by its larger size, averaging 3 mm., and by the differently shaped frontal triangle, which is comparatively longer and narrower than in *glabra*, with its sides converging appreciably less from front ocellus to anterior margin. The fore tarsi usually have the whole of the first joint and the basal portion of the second yellow, whereas in *glabra* both joints are blackened except, rarely, the base of the first joint, the clypeus also is generally yellow, very rarely slightly brownish.

In addition to the Illinois localities given in connection with the original description—Algonquin and Urbana—I have taken specimens at Centerville, August 16, and at Monticello, June 21; and I have seen specimens from Plummer's Island, Md., July 4 and 19, and from Anacostia, D. C., July 22,—taken by W. L. McAtee and W. D. Appel.

The following new species were taken by Mr. C. A. Hart and the writer in 1914.

Chloropisca parviceps, n. sp.

Female. Glossy yellow. Head yellow; occiput black, slightly shining; frontal triangle glossy black; basal joints of antennæ brownish black, upper margin of third broadly brown; arista fuscous, yellowish at base; face paler than frons; mouth parts entirely yellow. Disc of mesonotum glossy black, shading off into the yellow lateral margins; humeri with a large, poorly defined black spot; mesopleural spot black; sternopleural one yellowish red; scutellum with sides black at base, the remainder glossy yellow. Dorsum of abdomen glossy blackish brown, the posterior margins

[1] Can. Ent. vol. XLVI, 1914, p. 115.

of segments very narrowly yellowish, most noticeably so on the posterior lateral angles. Legs entirely yellow. Wings clear, veins fuscous.

Frons slightly wider than either eye; triangle very large, occupying the entire frons with the exception of a narrow stripe on each side of nearly same width as the anterior ocellus extending almost to the anterior margin, where the sides converge, forming a rather obtuse apex; frontal hairs weak; those on the lateral submarginal line of triangle most distinct; third antennal joint large, slightly longer than broad, rounded at apex; arista almost bare, slightly longer than width of frons anteriorly; profile of head slightly retreating towards mouth; cheeks linear, barely distinguishable. Disc of mesonotum with short, rather closely placed, blackish hairs; scutellum rather short, less noticeably flattened and more rounded than in most species of the genus, disc with several short black hairs, the apical pair of bristles rather widely separated, not cruciate. Legs slender; fore tarsi not broadened; sensory area on hind tibiæ half the length tibia. Inner cross vein of wing distinctly before apex of first vein; third and fourth veins almost straight; penultimate section of fourth vein about a third as long as ultimate section of fourth and subequal to last section of fifth. Length, 1-1.5 mm.

Type locality: Monticello, June 30. Paratypes from Centerville, August 16, and Mohamet, August 6,—all in Illinois.

C. grata Loew differs from *parviceps* in having the frontal triangle gradually tapering from vertex to anterior margin, the cheeks nearly as broad as third antennal joint, the scutellum conspicuously flattened, bare, with noticeable "rim," and the apical pair of bristles closely placed and generally cruciate; also differs in several minor respects.

Genus Gaurax Loew.

Through a mistake in selecting the type of the genus *Neogaurax* the writer, in the paper already referred to, inadvertently created a synonym of *Gaurax*, as its type possesses the generic characters of *Neogaurax*. It thus becomes necessary to rename the genus which contains the forms having the scutellum much elongated, flattened dorsally, and ending in an obtuse point, and I here propose for it the name **Pseudogaurax,** with the genotype *Gaurax anchora* Loew.

In describing 2 new species of *Gaurax* I take the opportunity of presenting a synoptic key for the separation of the described species of the genus. I am indebted to Prof. J. M. Aldrich for an opportunity to examine a specimen of *G. ephippium* from Mrs. Slosson's collection. I have added *dorsalis* Loew and *pilosula* Becker to the species already included in the genus as they obviously belong there. I have taken the former in Illinois, but the latter I have not seen. I am indebted to Professor Aldrich for in-

formation regarding the type of *pilosula* which has enabled me to place it correctly in the key and also for confirmation of my opinion as to its generic position.

KEY TO SPECIES.

1. Wings not entirely hyaline, either with a spot at apex of second vein or with a distinct infuscation 2
   Wings entirely hyaline 5
2. Wings with a small black spot at apex of second vein (Toronto, Can.). *pseudostigma* Johnson
   Wings with their greater portion infuscated 3
3. Thorax and scutellum black (Ill.) .... *fumipennis* Malloch
   Thorax mostly yellow and scutellum entirely so 4
4. Third antennal joint black; mesonotum without a white spot behind humeri (N. H.) .... *obscuripennis* Johnson
   Antennæ entirely yellow; mesonotum with a white spot behind humeri. *splendidus*, n. sp.
5. Halteres yellow 6
   Halteres with at least the knob black 7
6. Scutellum black (Pa. Ill., N. H.) .... *dorsalis* Loew
   Scutellum yellow (N. H.) .... *ephippium* Zetterstedt
7. Legs entire yellow (N. H., Vt.) .... *montanus* Coquillett
   Legs with distinct black marks 8
8. Thorax glossy black, lower half of pleuræ and scutellum yellow (Ill.). ***apicalis*, n. sp.**
   Thorax and scutellum yellow, disc of mesonotum with black marks (Pa.) .... *festivus* Loew
   Thorax and scutellum glossy black (La.) .... *pilosula* Becker

Gaurax apicalis, n. sp.

Female. Glossy black. Head orange-yellow; occiput and frontal triangle glossy black, sides of frons posteriorly brownish; face whitish yellow; antennæ yellow, third joint reddish above; clypeus blackish; palpi and proboscis yellow. Thorax glossy black, lower half of pleura and scutellum pale yellow. Dorsum of abdomen glossy black, venter obscurely yellowish, subopaque. Legs whitish yellow, a streak of postero-ventral surface of apical fourth of mid femora and the whole of the apical fourth of posterior surface of hind femora black. Wings clear, veins brown. Halteres yellow, knob black. Short hairs on body and legs pale. bristles black.

Frons slightly broader than the combined width of eyes, and, posteriorly, broader than long, the sides convergent anteriorly; triangle extending beyond middle of frons, equal-sided, the lateral margins slightly convex; orbits with rather strong hairs; antennæ of moderate size, third joint disc-like; arista slightly longer than anterior width of frons, hairs sparse, upright, not very long; cheeks almost indistinguishable. Disc of meso-

notum with short, rather closely placed hairs, the surface without distinct punctures; scutellum convex, short, rounded in outline, two long apical and two shorter subapical bristles on margin. Abdomen shorter than head and thorax combined. Legs rather long and moderately stout; sensory area of hind tibiæ not darker than surrounding portions. Penultimate section of fourth wing-vein twice as long as basal portion of third and distinctly, but not greatly, shorter than ultimate portion of fifth. Length, 2 mm.

Type locality: Mahomet, Ill., August 6, 1914 (J. R. Malloch).

Gaurax splendidus n. sp.

Male. Yellow, variegated with black. Head yellow; frons orange-yellow, opaque, triangle glossy, the upper margin blackened, vertex and occiput black; face, antennæ and arista reddish yellow; palpi pale yellow. Mesonotum honey-yellow, with the following black marks,—a narrow line on anterior margin, a small spot behind each humerus, and a broad dorso-central stripe which does not extend to anterior margin and is connected with a lateral tridentate mark on posterior margin, the outer portion of the latter being indistinctly connected with a spot on lateral margin at suture; anterior to the black lateral spot at suture is a large milk-white spot on each side; pleuræ blackened on upper half except one or two small portions where the yellow ground-color shows; scutellum lemon-yellow; surface hairs on thorax silvery white, scutellar hairs and bristles yellow. Abdomen black, yellow at base and on a narrow dorso-central line on second segment; venter greenish yellow; hypopygium black. Legs whitish yellow, blackened on apical half of anterior and postero-ventral surfaces of mid femora, apical half of posterior femora, with the exception of a narrow portion which divides the black mark, and the mid and hind tibiæ, except their bases and apices. Wings clear at extreme base, posterior to fifth vein up to cross vein and beyond that point posterior to fourth vein, the remainder black with the exception of a very narrow clear line along posterior margin of fourth vein from base to cross vein. Halteres yellow, knob black.

Head, viewed from above, twice as broad as long at center; frons more than one-third the head-width and distinctly broader than long, triangle extending more than midway to anterior margin; post-vertical bristles long, cruciate; surface of frons with a few hairs, a cruciate pair noticeable on center of anterior margin; antennæ normal in size, third joint very densely pilose, arista swollen at base, the hairs sparse and very distinct; cheek linear, with numerous hairs; eyes distinctly higher than long, surface hairs distinct. Mesonotum with silvery hairs which are most conspicuous when viewed from in front; scutellum with two long, cruciate apical bristles, and two much shorter ones which are not exactly on the margin but a short distance from it, on the disc. Abdomen tapering; hypopygium very conspicuous, recurved beneath abdomen, each of the lateral

arms ending in a rather prominent flattened process. Legs normal, the hind tibial sensory area distinct. Venation as in *apicalis*. Halteres with conspicuously elongated knobs. Length, 2.5 mm.

Type locality: White Heath, Ill., collected by sweeping herbage on bank of the Sangamon River, May 30, 1915 (J. R. Malloch).

This species was noticeable in the net by its very rapid motions, running swiftly up the sides, much more like a phorid than a chloropid, the latter being usually very slow and deliberate in action.

Botanobia (Oscinis) proxima Malloch.

This species is, I am convinced, a synonym of *minor* Adams. I have taken it in numbers in Illinois, and have reared it from volunteer wheat at Urbana.

Genus Pseudochlorops Mallock.

This genus was founded upon leg characters which readily separate the genotype from any species of the genus *Chlorops* and point to its much closer affinity with *Chloropisca*. An examination of a larger number of species of the latter genus than was possible at the time I erected the genus leads me to believe that although the scutellum in the genotype of *Pseudochlorops* is not so conspicuously flattened as that in most species of *Chloropsia*, its possession of a flattened area bounded by a weak "rim," renders it so unessentially different in structure from *Chloropisca* that it should not be considered as entitled to distinct generic rank.

Professor Aldrich informs me that the specimens named *Chlorops unicolor* Loew in the U. S. National Museum are misidentified, being *C. integra* Becker. This species therefore goes in *Chloropisca* and *Pseudochlorops* falls as a synonym of that genus.

A NEW NOCTURNAL SPECIES OF TACHINIDAE.

By W. R. Walton,

Bureau of Entomology, Cereal and Forage Insect Investigations.

Neophyto nocturnalis n. sp.

General color obscure grayish, head obtusely conical, antennæ very short, wings narrow, slightly infuscated especially bordering veins. Length 6 9 mm. Front in female one and one-third, in male, one-half eye width; cinereous, vitta nearly black; two pairs of orbitals in female, absent in male. Several pairs of smaller bristles, back of the ocellar pair. Frontals (fig. 1) not descending below base of second antennal joint in female, but ending distinctly above same in male. No frontal bristles directed distinctly backward. Antennæ black, third joint in either sex subequal with second, tip of antennæ descending but little below lower

margin of eyes. Arista black, bare, bulbous at extreme base. Facial plate very small, vibrissal angles closely approximated, vibrissæ rather weak, but distinct and strongly cruciate, situated well above oral margin. Cheeks in both sexes nearly as wide as eye-height, the anterior two-thirds occupied by the transverse impression which is greatly expanded and dark brown in color. Posterior part of cheeks and occiput cinereous. Facial ridges practically bare. A row of long, slender, ventrally directed macrochætæ extends on the face from opposite tip of second antennal joint to lower corner of eye, the longest of these subequal in length with arista. Front, on the sides, clothed with short black hairs arranged in more or less regular rows. Proboscis extremely short, labella fleshy, brown, palpi black, bearing a distinct brush of forwardly directed bristles at their tip. Thorax grayish brown, vittæ indistinct, pleuræ cinereous, sternopleurals usually three, many long erect hairs also present near them.

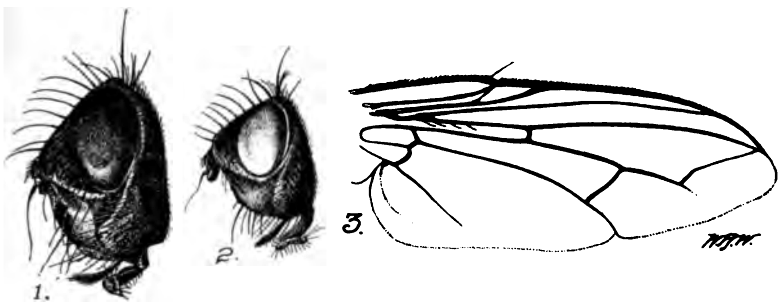


Fig. 1–3. Neophyto nocturnalis Walton.

Dorso-central bristles three; sometimes an irregularly placed fourth one present. Scutellum bearing three strong pairs of marginals, apical pair obsolete. Disc of same in the male bearing many long, nearly erect hairs, in addition to a discal pair. Abdomen elongate ovate in female, distinctly elongate and nearly cylindrical in male, slightly marmorate or pseudo-maculate as viewed from the rear. Also traces of a median vitta present in well-preserved specimens. Each segment bearing both discal and marginal macrochætæ although the former are sometimes asymmetrically placed. A slightly metallic sheen apparent on the darker portions of segments. Genitalia in both sexes retracted. Legs, including coxæ black, claws of male elongated, pulvilli fuscous. Wings (fig. 3) narrow, veins distinctly black. Costal spine fully as long as small cross vein. Apical cell closed slightly before costal margin entering same well before tip of wing. Bend of fourth vein distinctly angulated, bearing a wrinkle. Third vein bristly, nearly half way to small cross vein, squamæ yellowish white, head of haltere fuscous. The posterior cross vein in this genus is subject to freakish developments; a specimen of *setosa* Coq. (fig. 2) in the

National Museum collection bears stumps of veins on both the inner and outer sides of this vein while one of the females in the series before me possesses an extra short vein, originating at the middle of the posterior cross vein (which is bent outward at a distinct angle) and running parallel with the fourth vein, before its bend, nearly to posterior border in either wing.

Species described from four specimens, male and female, all collected at electric lights at night, Forest Glen, Md., by Mr. Otto Heidemann, April 19 to 28, 1914.

Structurally this species closely resembles *setosa* Coq., but differs as follows: Wing veins black, wings distinctly smoky, entire body pollinose and much darker in general color. Sides of face in transverse depression much darker brown, abdomen with reflecting spots, head more obtusely conical in side elevation, average size much larger. It is possibly entirely and certainly partially nocturnal in habit of flight. Judging from this fact and the habitus of the fly it seems probable that this genus is parasitic upon nocturnal Coleoptera, possibly *Lachnosterna*.

Mr. R. C. Shannon has previously[1] mentioned the nocturnal habit of this interesting fly.

A FEW NOTES ON THE HABITS OF PARASITIC HYMENOPTERA.

By W. Dwight Pierce and R. A. Cushman,

Bureau of Entomology, U. S. Department of Agriculture.

In the course of several years spent in the study of parasites a number of interesting observations have been made which are of interest to the biological entomologist but have no direct bearing upon any economic problem. A few of these records which are considered worthy of publication have been gathered together to form the present paper.

Among the hymenopterous parasites sexual attraction seems to be a strongly developed instinct. In the Braconidæ under observation there is no courtship, the mating taking place almost immediately. This was first observed and noted for *Sigalphus curculionis* Fitch on April 30, 1908 (W. D. P). The male whenever it came close to the female fanned its wings very rapidly and finally jumped on her back, but was off in a second. A little later it approached again and this time was attached for forty seconds. Observations of other braconids were of the same nature.

Among the Chalcidoidea studied, a very interesting courtship always precedes mating. On June 15th the actions of a pair of

Catolaccus incertus were observed for forty-five minutes (W. D. P). During this time the male was on and off, but for thirty minutes in all he was perched on the back of the female. He was only one-half her length and as he rested on her thorax, with his front feet placed on her face, his hind legs rested on the apex of the thorax, and the tip of his abdomen reached no further. The wings of the male were upright while those of the female lay in repose. The antennæ of the latter were very active, communicating a message by some wigwag code, now one, now both, now fast, now slow, tapping the face of her mate or moving in his sight; and in response, the antennæ of the male frequently came down and touched the tips of her antennæ or tapped on her face. His antennæ were, however, much oftener quiet and pointing to the front. Another peculiar action was the sudden darting back to the abdomen, which was sometimes forced by the female pushing the male back with her hind legs, but he each time, ran back to his original position or jumped off. The male seldom was aware of the presence of the female at a greater distance than a quarter of an inch, but the latter's perception was much greater. When conscious of his mate's presence the male's antennæ were very active in dispatching a wireless message, only ceasing when it was again perched on her back. The actual copulation was not witnessed.

On September 10th, the courtship of a pair of *Cerambycobius cushmani* Crawford bred from huisache pods was recorded (R. A. C.) This was conducted very differently from that just described and so is worthy of equal mention. They first met face to face and the male began stroking her antennæ which were held up in front of his face. After doing this for a few seconds he jumped on her back and continued very rapidly stroking her antennæ, which were held up in front of his face. This action lasted for some seconds, and he then walked backwards down under the end of the female's abdomen until the tip of his body was just under the anterior end of her abdomen, when the connection took place. This did not last more than a second. When the male left the female his copulatory organ was still protruding about one thirty-second of an inch and appeared black and chitinous. In a few seconds the process was repeated exactly as before except that the copulatory organ was retracted before the male left the female.

The courtship and mating of *Eurytoma tylodermatis* Ashmead and *Microdontomerus anthonomi* Crawford, *Bracon mellitor* Say, *Urosigalphus bruchi* Crawford and *Microbracon nuperus* Say were also witnessed, but not recorded. Several experiments were conducted to settle the specific distinction between *Cerambycobius cyaniceps* Ashmead and *Cerambycobius cushmani* Crawford. In no case did the one species pay any attention to the opposite sex

of the other, thus partially proving them to be distinct, while on the other hand it was an easy matter to induce courtship between the two sexes of the same type.

The sexes are usually of quite different size, the female frequently being three or four times the size of the male. The size is determined partially by the amount of the food supply, there being large and small males and females, although the majority of the small individuals are male and of the larger individuals are female.

By means of a mica plant-cage some very interesting observations were made upon the method of oviposition by several of the species. On October 6, 1908, a female *Catolaccus incertus* was observed (R. A. C), crawling on an infested square and tapping it here and there with her antennæ. She finally inserted her ovipositor in the last spot investigated. This was done in the following manner. She raised herself to the full extent of her legs and at the same time dropped the tip of the abdomen until it touched the square, when the abdomen was practically perpendicular to the square. After holding this position for a second, during which time she made several jabs with the sheath, the abdomen was straightened out to the normal position while the ovipositor still remained inserted in the square. In forcing the ovipositor in, she moved the abdomen from side to side and the venter was pushed down until the abdomen became triangular in profile. The effort was not successful.

On September 14, 1908, at Arkadelphia, Arkansas, the late Mr. Clarence E. Hood observed a *Catalaccus hunteri* Crawford ovipositing in a dry square. The ovipositor was nearly halfway into the square when first seen, and the triangular process at the base of the ovipositor was plainly visible. The ovipositor was perpendicular to the line of the body on the anterior ventral part of the abdomen. The operation of forcing the ovipositor into the square worked on the principle of an augur, with the ovipositor as the bit and the body as the brace. By turning around and around the ovipositor was forced into the square its entire length. The parasite them remained practically quiet for perhaps two minutes, a very slight movement of the abdomen being the only action noticed. After the operation was finished the ovipositor was very suddenly removed and snapped back into the sheath.

On October 23, 1908, at Natchez, Miss., one of us (W. D. P.) picked up a square from a plant and found a female *Catolaccus hunteri* with its ovipositor inserted to the limit. The abdominal triangular process was very large. The female did considerable turning to right and left, sometimes going almost around the ovipositor and then turning back the other way. The operation complete, the abdominal process was drawn in, but

around it several times before she could pull it out. It was replaced slowly in the sheath. During the long operation the antennæ hung pendant in front of the eyes. This observation was made shortly after 3.30 p.m. and lasted eighteen minutes.

On October 2, 1908, at 3.30 p.m., the authors and Mr. Hood were able to observe the oviposition of a female *Cerambycobius cyaniceps* Ashmead. The parasite having located with her antennæ a suitable spot, walked ahead until her abdomen was directly over the spot, then raising the abdomen and at the same time curving it beneath until the ovipositor sheath was perpendicular to the square at the spot selected. With a sudden jabbing movement the square was pierced. The sheath was removed immediately and the abdomen straightened to its normal position. The ovipositor being still in a vertical position, was quickly inserted its entire length. Then by an up and down movement the portion of the abdomen at the base of the ovipositor was pushed out into a triangular process. During the process of oviposition the abdomen was moved from side to side and the ovipositor was frequently drawn partially out and again inserted. During the operation, which lasted about four minutes, the antennal flagella were hung in a downward vertical position in front of the face. When the process was completed the ovipositor was withdrawn very suddenly and snapped back into the sheath.

On October 6, 1908, this same species was observed trying to oviposit at 9.00 a.m. at a temperature of 69° and under a cloudy sky. At 11.00 o'clock on the same day, with a temperature of 70° and the sky 100 per cent cloudy, a female was observed to oviposit, taking seven minutes for the process. Observations on this day were continued and the parasites were found to work at all times of the day and in all conditions of sunlight. The longest period of oviposition which was recorded lasted fifteen and a half minutes.

On November 2, 1908, at 11.00 a.m., Mr. Hood recorded the oviposition of *Sigalphus curculionis* Fitch. The female crawled over the square, feeling of it with her antennæ. After finding a suitable spot her abdomen was raised until nearly vertical and then the ovipositor swung down and was placed for insertion at a point directly between her front legs. The sheath was forced in on a slant by one continuous push. The sheath was then removed and the ovipositor was forced in by an up and down motion. During this movement she turned around half way and in a short time returned to her first position. After about three minutes her ovipositor was removed.

These records of oviposition have been given in detail on account of the extreme scarcity of accurate observations on the method of oviposition by parasites.

AN EASTERN CHILOSIA WITH HAIRY EYES.

(*Diptera, Syrphidæ.*)

By R. C. Shannon, *Bureau of Entomology.*

Chilosia primoveris, new species.

Male: Robust species; shining, dark metallic green. Eyes hairy; vertex with long light colored hairs with black ones intermixed; frontal triangle with long erect black hairs and a furrow running down the middle; first two antennal joints deep reddish brown, the third a shade lighter; arista concolorous with the third joint and with microscopic pubescence on basal third. Face with light colored hairs and very fine pubescence, the tubercle distinctly nearer the oral margin than to base of antennæ and projecting far beyond latter.

Dorsum of thorax with rather long and dense whitish pile and mesopleura with long black hairs; post-alar callosities with fine long black and whitish hairs in tufts; scutellum covered with long whitish pile like that on mesonotum and with a few coarser black or yellow ones on the margin.

Abdomen slightly narrower than thorax, shining dark metallic green, with rather thick white pile.

All the femora black, their tips brownish-yellow, tibiæ yellow, with broad black rings around the middle; tarsi on outer side more black than yellow, on under side largely yellow.

Wings tinted with yellow, their bases dull brown which merges into yellow as it spreads out over the wings. Spurious vein weak; last section of fourth vein with two angulations which have very short stumps at their apices; the second spur, which projects into the first posterior cell, sometimes obsolete, the part of the vein beyond this last broadly curved outward. Length: 6–8 mm.; wing 6–7.5 mm.

Female: Frons narrower than one eye, narrowing towards vortex, with a broad transverse depression a short distance above antennæ and a weak longitudinal groove running from ocelli to the depression; frons clothed with light yellow erect pile which is longer in the ocellar region. Facial tubercle more prominent than in the male.

Mesonotum with some coarser hairs scattered through the light pile. Mesopleuræ with light pile.

Abdomen broader than thorax and with shorter pile than in the male. Last section of fourth vein with only slight trace of the second angulation and rarely with trace of stump. Length 5–7 mm.; wing 5–7 mm.

Type locality: Plummers Island, Md. (Male type, April 16, female allotype April 25, 1915, R. C. S. coll.)

Type Cat. No. 19786, U. S. N. M.

Described from 45 specimens; paratypes from Plummers Island, Md. opposite Plummers Island, Cabin John and Great Falls, Md.; Dead Run Fairfax Co., Va., April 7–25. (R. C. Shannon, J. C. Crawford, and W. L. McAtee, collectors).

This species runs to *C. petulca* in the table in Williston's Synopsis of the North American Syrphidæ. In comparison with the type of that species it is smaller, more robust, and darker shining metallic green. The arista of *petulca* is longer and with distinct pubescence to the tip; all three antennal joints are more yellow; the frons is yellow at base of antennæ. The body pubescence of *petulca* is very short and thinly scattered, the hairs on the scutellar margin stronger, shorter and black. The wings of *petulca* are comparatively longer; the last section of the fourth vein is much nearer the wing margin and runs nearly parallel with it. Its legs are of a more uniform color.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVII 1915 No. 4

Two Hundred and Eighty-Seventh Meeting, June 3, 1915.

The 287th regular meeting of the Society was entertained by the Executive Committee at Saengerbund Hall, June 3, 1915. The following were present: Messrs. Barber, Böving, Caudell, Craighead, Crawford, DeGryse, Ely, Greene, Hall, Heinrich, Hood, Jackson, Knab, McIndoo, Middleton, Quaintance, Sanford, Schwarz, Shannon, Snyder, Strauss, Turner, members, and Mr. R. M. Garner, visitor.

The following papers were presented:

A NEW SPECIES OF CEPHENOMYIA FROM THE UNITED STATES.

(*Diptera; Œstridæ*)

By W. D. Hunter.

In November, 1910, the late F. C. Pratt obtained a number of œstrid larvæ from the nasal passages of a deer (*Odecoileus virginianus texanus*) which was shot in the vicinity of Sabinal, Texas. By exercising extreme care Mr. Pratt succeeded in rearing two adults, a male and a female. In addition to the adults the writer has in his possession three puparia and five larvæ from the same source. The species has been found to be new and is described herewith.[1]

The only American species described under the genus *Cephenomyia* is *phobifer* Clark. As has been pointed out by Brauer this

[1] On first examination it was thought to be a European form and was referred to as such by the writer, see Proc. Ent. Soc. Washington, XIII, p. 88.

form, in all probability, does not belong to the genus *Cephenomyia*. At any rate Clark's description and the notes by Brauer show that it is entirely distinct from the form described in this paper.

Brauer[1] described a larval *Cephenomyia* obtained from *Cervus macrotis* in North America (not named in body of work but referred to as *C. macrotis* in index) and also recorded[2] the larva of *Cephenomyia ulrichii* Brauer from an American elk. Both of these forms are quite distinct from our species. Brauer also listed *Cephenomyia* sp. from "Durango."[3] The remaining American records of *Cephenomyia* are two notes in Insect Life, concerning the finding of larvæ in hogs in Virginia[4] and in man and deer in California.[5] The California specimens from the deer have been examined by the writer. They appear to be the same as the form described in this paper. The specimens from man are immature and cannot be determined.

Cephenomyia pratti n. sp.

Male. Ground color everywhere shining black. Pile of body light yellowish white except a few hairs between the antennæ and the eye margins, a broad band extending across the dorsum of the thorax, and the first three abdominal segments which have black pile. The pile of the legs is black except a white tuft at the base of the inner side of all the femora. Length 13 mm.

Female. Ground color shining black as in male, no pulverulence. Pile of head light yellowish white except between the base of the antennæ and the eyes. Pile of thorax and scutellum whitish except for a broad black transverse band between the bases of the wings. This band is interrupted in the middle by yellowish hairs. Pile of first three abdominal segments bright ferrugineous, of remainder whitish. Pile of legs black, except white tufts at bases of inside of all femora.

Eye margins converging toward vertex. Antennæ black, arista dark brown. Wings black at extreme base, otherwise hyaline, veins brown. Venation typical for genus. Tegulæ whitish, very narrow margin brown. Legs black, posterior femora and tibiæ slightly brownish. Claws black. Pulvilli whitish. Length 13 mm.

Described from two specimens, Sabinal, Texas, November and December.

Host: Cervus virginianus texanus.

Type: Cat. No. 19966, U. S. National Museum.

The name is in honor of the late F. C. Pratt.

[1] Monographs der Oestriden, pp. 211-212.

[2] L. c., p. 202.

[3] Die zweiflugler des kais. Mus. Wien. III, p. 82, 1883.

[4] III, p. 151.

[5] II, p. 116.

The affinities of this species as shown by the adults and immature stages are with *C. ulrichii* Brauer. It differs, however, in not having the eye margins parallel above in the female, in not having interrupted transverse band of yellow pile on the abdomen and in having anterior femora with white hairs on the inner side at the base. It is also considerably smaller in size.

Larva: Third stage. Differs from its nearest relative *C. ulrichii* in having spines on segments 3–4 large and subequal.

Length 26–39 mm. Color yellowish brown, each segment with circular black spots, more numerous on posterior segments. Mouth-hooks arcuate but not curved backwards.

Upper side. Spines large, black, numerous, all those on segments 2–3 nearly equal in size, further described as follows: head segment (seen from in front), three irregular rows, those of the first row larger; first segment none; second segment two to three irregular rows subequal; third segment, three to four irregular rows, those of first rows equal in size, in third row somewhat smaller; fourth segment, four rows, subequal, three isolated spines on lateral posterior margin; fifth segment, four rows anteriorly and four to eight in lateral posterior rows; sixth segment, five anterior rows, spines of last rows considerably smaller, six to eight in posterior lateral rows; seventh segment, five to six rows smaller toward rear, lateral posterior rows of six to eight spines; eighth segment, seven irregular rows, the first having the spines well separated, about six spines on posterior lateral margins; ninth segment, four rows, well separated, two to three on posterior lateral margins; tenth segment with only two to three spines on each side near anterior margin, and two entire rows on posterior declivity.

Lower side. Second segment, two rows in middle, three on sides; third segment, four rows, subequal; fourth segment five rows, those of first two somewhat larger; fifth segment, six to seven rows, those of first two rows considerably larger; sixth segment, seven rows; seventh segment, seven rows; eighth segment, six rows more sparsely placed than on preceding segments; ninth segment, like eighth; tenth segment, four to five rows, isolated; eleventh segment, on anterior margin at middle, three short rows, one on sides, under posterior declivity, one transverse and three semi-circular rows.

Posterior stigma large, interior margins parallel, no indications of radiating lines, black, with three to four small shining tubercles near lateral margins.

Described from five specimens.

Puparium: Above. Second segment, three rows of spines; third to eighth segments, three to four rows; ninth segment, one row in middle, two on each side; tenth segment, one row interrupted in middle. Dried specimens show numerous fine transverse ridges which are not evident in alcoh Black. Length 20 mm., width 7 mm.

1

2

3

4

EXPLANATION OF PLATE XVI.

Cephenomyia pratti Hunter.

Fig. 1. Skin of dorsum of larva in third stage, cleared and mounted in balsam.

Fig. 2. Puparium.

Fig. 3. Posterior stigmata of larva.

Fig. 4. Larva, ventral view of anterior portion.

Described from three specimens.

The writer is indebted to Messrs. F. Knab and N. Banks for advice regarding the specimens used in the preparation of this paper

NOTE

Since the manuscript of this article was submitted for printing an important paper by Dr. J. M. Aldrich has appeared: The Deer Bot-Flies (genus *Cephenomyia* Latr.), J. N. Y. Ent. Soc. XXIII, pp. 145–150, 1 pl. Dr. Aldrich describes a new species under the name *abdominalis*. This species, however, is quite distinct from *pratti* in the striking difference in the color of the abdominal pile and in the dark anterior wing margins, which Dr. Aldrich informs the writer are even darker than this illustration shows, in fact quite blackish from the anterior cross vein forward.

SOME MODIFICATIONS OF THE HYPOPHARYNX IN LEPIDOPTEROUS LARVÆ.[1]

By J. J. DeGryse.

Branch of Forest Insects, U. S. Bureau of Entomology.

In his morphological study on the mouthparts of Crustaceans and Insects,[2] published in 1893, H. J. Hansen contends that the paired appendages existing on the sides of the hypopharynx

---

[1] Since writing this paper I had the opportunity of again examining Lyonet's Traité anatomique de la Chenille qui ronge le bois de Saule (The Hague, 1762). His figures of the labium and hypopharynx are most interesting especially from the standpoint of the internal anatomy of the lower lip. He refers to the so-called maxillulæ as "Rebords de la Lèvre inférieure." In Chap. IV, p. 62, he gives his theory of the function of these organs. In spite of the imperfection of his instruments, Lyonet's dissections are remarkably accurate. The shape of the chitinous blades or spines was no doubt beyond the power of his microscope. As to the arrangement of the muscles, I think there is a slight confusion in the drawing (Lyonet, Pl. XVII, fig. 25), though in the text (Chap. XVII page 563), the author supposes the existence of other muscles, besides those figured in Pl. XVII, by so doing he partly solves our difficulty. I have not studied the particular species described by the master, but from a comparison with other lepidopterous larvæ, it is probable that his muscle *I* should consist of two different muscles *I′* and *I″*. *I′* is attached dorsally to the mental arm and ventrally to the threadpress on the salvary glands. *I″* is attached dorsally to the same press and ventrally to the mentum. Each of these muscles is provided with a separate embranchment *C′* and *C″* of the trachea indicated by the letter *C* in Lyonet's drawing. (See pl. 19, fig. 7).

[2] "Zur Morphologie der Gliedmassen und Mundtheile bei Crustaceen und Insekten." Zool. Anz. XVI, 1893, pp. 193–8 and 201–212.

in Thysanura and Collembola are in reality second maxillæ, homologous with the first maxillæ of Crustacea. Older authors, considering these organs as part of either the hypopharynx or the labium, called them "paraglossæ." Hansen rejects this term and substitutes for it the term "maxillulæ" as a more appropriate name. Since the publication of Hansen's paper, several authors have shown the existence of these so-called maxillulæ or of apparently homologous organs in various orders of insects.[1]

Of late, the most interesting contributions on the subject are two papers, one by G. H. Carpenter and Mabel McDowell: "The Mouthparts of Some Beetle-larvae" (Quart. Journ. Micr. Sc. LVII, 1912, pp. 373–96), the other by G. H. Carpenter: "The Presence of Maxillulæ in Beetle-larvæ" (Transact. 2d. Internat. Congr. of Entom.)

The existence of maxillulæ in Lepidoptera was first recognized by Busck and Böving. Their description of this organ is found in their joint paper: "On *Mnemonica auricyanea*" (Proc. Ent. Soc. Wash. XVI, 1914, no. 4, 151–63). Dr. Böving first discovered the maxillulæ in the imago of *Mnemonica* and later pointed out in my drawings, what he considered to be corresponding structures in the larva. In our paper on *Acrocercops strigifinitella* (Proc. Ent. Soc. Wash. XVII, 1915, no. 1, pp. 10, pl. VI, fig. 1, pl. VII, fig. 3) Mr. Heinrich and the writer have described and figured the maxillulæ in the larva of that species. I know of no other direct reference to this organ in the literature on Lepidoptera.[2]

Independently from the intricate question of their true nature, these organs invite our special attention on account of their interesting modifications. The object of this paper is to describe a few of the most extreme types as they appear in the lepidopterous larvæ. The material examined for this study is scattered over some twenty widely divergent families. Only a few forms are described in this paper as representative of the most remarkable cases met in the course of researches.

The maxillulæ, or paraglossæ or superlinguæ[3] are situated on the lateral edge of the hypopharynx. In the lepidopterous larvæ, they essentially present the appearance of protuding fleshy

---

[1] For Bibliography cfr. G. H. Carpenter: "The Presence of Maxillulæ in Beetle-larvæ." Transact. 2d. Internat. Congr. of Entom, pp. 208–215, in appendix of the article.

[2] Dampf in his paper: "Zur Kenntniss gehäusetragender Lepidopterenlarven" (Zool. Jahrb. suppl. 12 H. 13, 1910.) gives a rough figure of these appendages in *Eumeta* sp. and considers them as belonging to the hypopharynx.

[3] The term "superlinguæ" is used by Folsom in his text-book on Entomology (pp. 39–40), 1906.

lobes, covering the floor of the buccal cavity wholly or in part only, as the case may be. These lobes are generally clothed with flexible lashes, with hairs or with rows of strong spines. They attain various proportions in all directions; so far, I have found that relatively to the size of the hypopharynx they attain their greatest dimensions in some of the microlepidoptera. In many instances the lobes are also furnished with chitinous blades, these again, are subject to the most extreme modifications both as to their general shape and to their location on the lobes.

Although really distinct from the hypopharynx the chitinous projections of the mentum[1] marking the exterior of attachment of the maxillulæ, should be mentioned in connection with these organs, as they are, in some cases at least, subject to modifications of real interest. In *Mnemonica auricyanea* Wlsghm., arms from the mentum enter the mouth cavity and are fused at the base of the hypopharynx, forming a complete ring, with a conspicuous plate at the point of fusion. The lobes of the maxillulæ originate at the forward edge of this plate. They appear as membranous flaps, clothed on their inner edge with a row of long cilia-like hairs. The appendicular nature of these lobes can readily be recognized, as they can be laid to one side and often will take this position under the mere pressure of the coverglass of the microscopic slide. Slightly forward of the above mentioned plate, we find on each side of the hypopharynx a row of four or five minute teeth. These are a part of the maxillulæ, but not the whole organ, as was inferred by Busck and Böving in their paper on this species. (For figure, cfr. Busck and Böving "On *M. auricyanea*," loc. cit. pl. XI, fig. 8).

The mouth-cavity of *Ectœdemia heinrichi* Busck, presents a totally different aspect from that of *Mnemonica.* Here, the arms of the mentum suggest the shape of a boot. They are very slender and reach only a short distance over the lateral edge of the hypopharynx. From the extremities of these arms arise two fleshy lateral lobes, somewhat corrugated in appearance and covered with filaments and spines. They are partly hidden by the blades. These consist of a set of enormously developed plates, they overlap and cover the entire floor of the basal part of the mouth-opening (cfr. pl 18, fig. 5). In a species of *Gracilaria* collected on *Alnus* by Prof. Charles R. Ely, we find what might be called a typical form of the modifications studied in this paper.

---

[1] The term "Mentum" is applied sensu Dampf: "Zur Kenntniss gehäusetragender lepidopteren larven (loc. cit). It applies to the part designated as stipes labii in our paper "On *Acrocercops strigifinitella*" (Proc. Ent. Soc. Wash., loc. cit.); cfr. also Busck and Boving "On *Mnemonica auricyanea*" (Proc. Ent. Soc. Wash., loc. cit.).

The three elements are developed to fairly equal proportions. The arms of the mentum approach in general outline those of *Ectœdemia*, but they are wider and the foot of the boot becomes much larger. To each of these arms is connected a fleshy lobe with the usual filaments and hairs along the anterior portion and covered with bristly spines, arranged in parallel rows towards the base. The lobes are attached to the upper edge of the hypopharynx by means of transparent chitinous rods. The blades projecting from and above these lobes are arranged in a longitudinal row. The three front blades are short and broad, the others are slender and finger-like, all arising from a common, narrow base (cfr. pl. 17, fig. 3).

The arms of the mentum in *Acrocercops strigifinitella* Clemens, are very thin bands of chitin, presenting a ragged appearance at their extremities. The lobes are developed to vast proportions and a pronounced chitinization marks their line of junction to the hypopharynx. The interior surface is finely striated, the exterior being covered with filaments. The blades consist of a row of translucent plates. They have moved to the apex of the lobes. On examining these blades under oil-immersion it was found that the two lower ones are placed so closely to the arms of the mentum as to appear attached to these processes (cfr. pl. 17, fig. 4).

In an undetermined sesiid larva taken from the roots of cottonwood, we find the arms of the mentum quite long but projecting only slightly over the hypopharynx. The lobes are reduced and covered with spines. The blades are very similar in shape and in texture to those in *Acrocercops strigifinitella*, but their line of attachment corresponds better to that in the other gracilariid larva described above (cfr. pl. 18, fig. 6).

Lagoa crispata, *Papaipema nitela* in the macro-lepidoptera and *Coleophora veroniaeella* in the micro-lepidoptera are representative of the most commonly occurring type, with well defined arms, fleshy lobes covered with spines but devoid of all traces of blades (cfr. pl. 17, figs. 1 and 2 and text fig. 1).

From their location in the buccal cavity we naturally assume that the function of the organs described above is relative to the feeding of the caterpillar. Most probably they facilitate the entrance of food into the alimentary canal, maybe they are also, in a certain measure, auxiliary to the mandibles in the mastication of the food particles. In none of the specimens have I found muscles belonging to the maxillulæ themselves (viz. lobes or plates).

It would appear then, that their movements are controlled by the muscles attached to the mentum and its arms. In this

event, they are merely secondary to the general functions of the hypopharynx. The main movements of the latter organ are produced by the mental-tentorial muscles *B* (pl. 19, fig. 7) and the mental-zygomatic muscles *A*. These, when acting simultaneously, cause the retraction of the entire labium and acting independently cause the elevation and depression of the same.

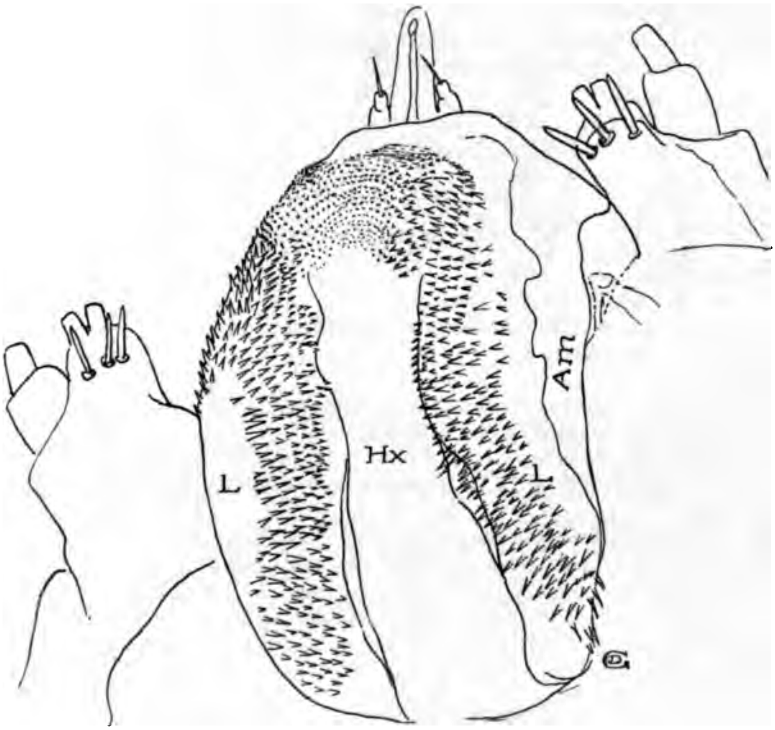


Fig. 1. *Papaipema nitela* Guenee.

Inasmuch as the mental arms are often very thinly chitinized and hence more or less elastic, it is not improbable that a slight inward and downward movement be imparted to the maxillulæ by the play of the muscles I' and I'', although these are primarily intended for dilation of the threadpress (pl. 19, fig. 8) and various movements of the spinneret *S* (pl. 19, fig. 7).

Many questions readily arise in the mind concerning these organs or their parts. The answer to such however must be reserved until more extensive and more minute studies have been completed. Above all things what seems to be of no little significance is that, so far, we have found a striking conformity of type within the genus and at the same time most widely diverfent forms within the same family.

The writer is greatly indebted to both Dr. Böving and Mr. Heinrich for many valuable suggestions and especially to the latter for material for study.

Explanation of Plates.

PLATE XVII.

Fig. 1. *Lagoa crispata* Pack.

Fig. 2. *Coleopohora veroniæella* Chambers.

Fig. 3. *Gracilaria* sp.

PLATE XVIII.

Fig. 4. *Acrocercops strigifinitella* Clemens.

Fig. 5. *Ectædemia heinrichi* Busck.

Fig. 6. Sesiid larva.

Hx = Hypopharynx; *L* = Fleshy lobes; *B* = Blades; *Am* = Arms of mentum.

PLATE XIX. *Telea polyphemus*, Cramer. Anatomy of lower lip.

Fig. 7. Side view of labium and hypopharynx.

A = Mental-zygomatic muscle; *B* = Mental-tentorial muscle; *Am* = Arm of mentum; *L* = Fleshy lobe; *S* = Spinneret; *C*, *C′*, *C″* = Tracheæ; *Sd* = Salivary ducts; *I′*, *I″* = Dilator muscles of the threadpress; *G* = Filippi's glands.

Fig. 8. Threadpress.

I′, and *I″* = A few of the muscle attachments.

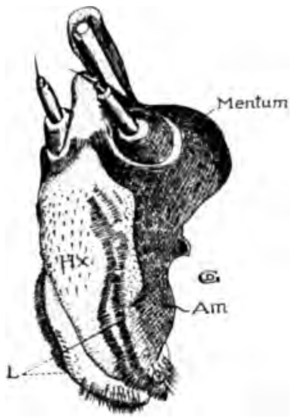


FIG 1

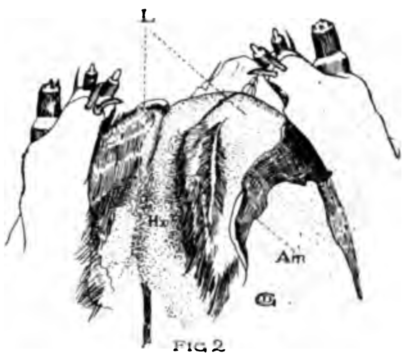


FIG 2

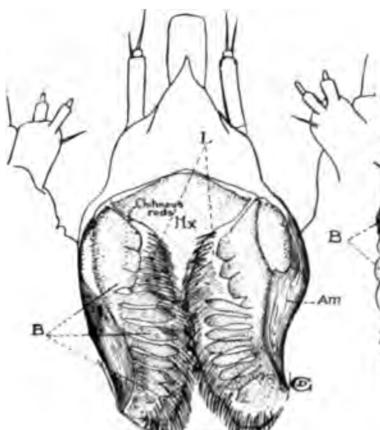


FIG 3

FIG 4

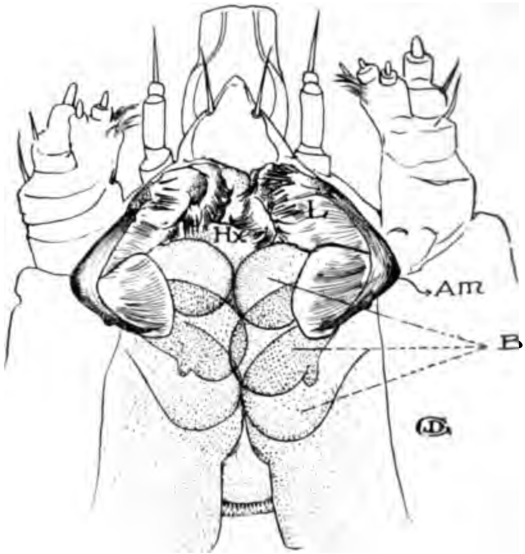


FIG. 5

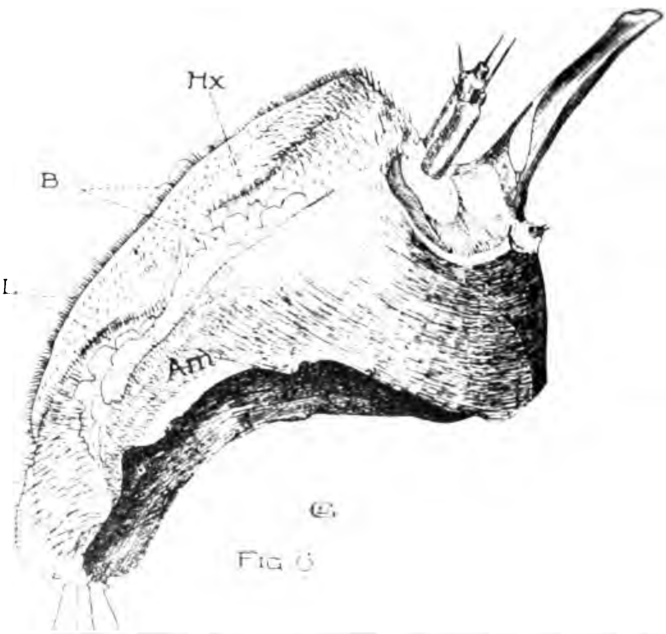


FIG. 6

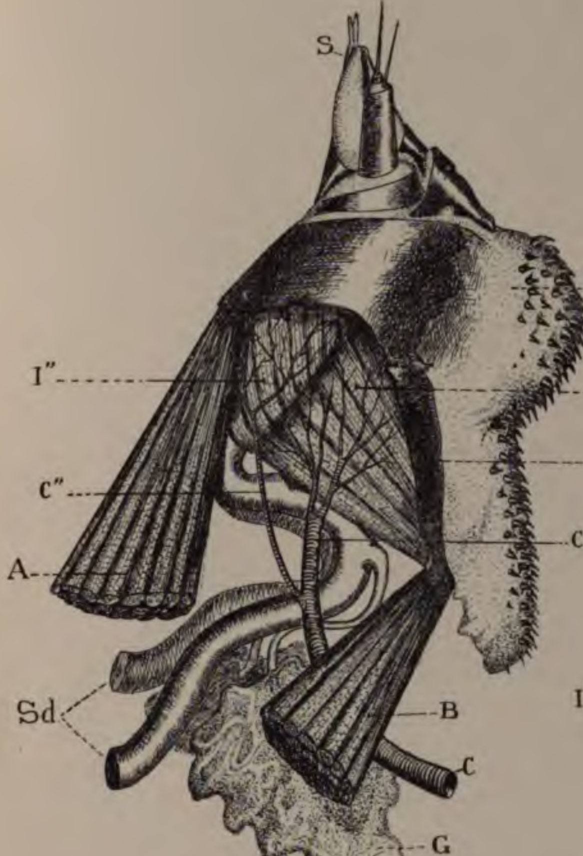


FIG 7

FIG 8

In commenting on this paper Mr. Heinrich stated that in addition to the interesting morphological questions involved, the maxillulæ promised to be of prime taxonomic importance as indicating generic differences in the larvæ of the specialized micro groups at least. From the material examined it would seem that there are two distinctive types of maxillulæ, a simplified type common to the Macros and pyraloid groups and a specialized type common to the Micros, as defined by Mr. Busck. It is also interesting to note that while these organs vary according to the manner of feeding, as could be expected, the two types are maintained under the same biological conditions.

NOTES ON THE HABITS AND ANATOMY OF HORISTONOTUS UHLERII HORN.

(*Coleoptera; Elateridæ.*)

By J. A. Hyslop, *Bureau of Entomology.*

The larvæ of the tribe Cardiophorini in the Elateridæ have long been recognized. Schiödte, Perris and Henriksen have all given good descriptions and several good figures have been produced of the larvæ of the genus *Cardiophorus*. Notable among these figures is the excellent one of *Cardiophorus asselus* by Schiödte.[1] So far as I am aware, the figure of *Horistonotus uhlerii* by Mr. W. R. Walton, in the recent Department Bulletin[2] on wireworms is the first figure of any other genus in this tribe. At the time this figure was prepared only preserved material was at hand. This spring through the kindness of Mr. E. H. Gibson, I have received several living larvæ of this insect from Charleston, Missouri.

The larva of *Horistonotus uhlerii*, as has already been recorded, lives in sandy situations where it feeds on living vegetable matter. The rapidity with which the temperature and humidity of its habitat follows the atmospheric changes is extreme when compared with more impervious soils. The sand rapidly dries out to a considerable depth in dry weather and becomes cold correspondingly abruptly with a fall in atmospheric temperature, the lag being considerably reduced by the open nature of the soil. Elaterid larvæ, as we have had very forcibly demonstrated in our rearing experiments with these insects, are extremely

---

[1] Meta. Eleuth. Obs., 1871.
[2] Bull. 156, U. S. Dept. Agric., 1915, fig. 3.

sensitive to rapid changes in temperature and with but few exceptions cannot stand desiccation in the slightest degree. The body structure and activities of *H. uhlerii* are admirably adapted to overcome these adverse circumstances of environment, not by resisting the elements but by making it possible for these animals to change their position in the soil with the variations of climatic conditions so as to always be in a stratum where the environment is compatable with their development or at least their existence. As the sand dries out, or as the cold weather approaches they rapidly burrow downward, conversely as moisture rapidly saturates their porous nidus or the temperature rises they move as rapidly upwards, and may even make daily upward and downward migrations to accommodate themselves to the ephemeral changes in temperature and humidity. The nature of their habitat makes the construction of permanent burrows impossible, hence the remarkable development of their bodies. The extremely broad palmate and digitate retractile anal lobes, form a backwardly directed pushing organ wonderfully designed to prevent any backward movement of the abdomen when burrowing in the loose sand, the spined caudal appendage on the ninth abdominal segment also assisting in this function. When moving foreward the larva contracts the abdomen by completely invaginating the anterior area of each abdominal segment within the posterior area of the preceding segment; the anal lobes are retracted as are also the lateral and ventral ambulatory papillæ, thus offering no resistance; the anterior part of the body is prevented from moving backward by the broad, spine beset surface of the tibiæ and tarsi of the legs, which may be assisted by the mandibles. The lateral papillæ and anal lobes are now exserted and the body starts to exert a pressure foreward by the longitudinal expansion of the segments, the mandibles work rapidly in an absolutely lateral plane, their concave outer surface pressing back the sand on each side much as do the short mannæ of the mole, the mouthparts with their stout brushes probably also assist in clearing the way. These brushes undoubtedly prevent sand from being forced into the buccal cavity. When on a hard surface the larva moves the head and mandibles very rapidly at the same time tremulously jerking the fore part of the body from side to side. The legs are also kept rapidly moving. When placed on moist blotting paper the head is applied to the paper, and the stout mandibles soon tear an opening through the fibers of the paper, the tearing action is confined to the outward thrust of the mandibles, the stout teeth on the inner surface not coming into play and probably only being used to lacerate plant tissue when feeding. When moving backward the ventral papillæ play the most important part. These are directed forward and

when the hold of the mandibles and legs is released and the body contracted they prevent the segment slipping forward. On a hard surface the caudal lobe of the ninth abdominal segment also assists in backward motion. In this case it is bent downward and acts as a hook shaped anchor.

The following technical description will more fully describe the details of these structures and also serve as a means of determining these larvæ:

Horistonotus uhlerii Horn.

Larva. (pl. 21, fig. *a*). Elongate, slender and membranous, twenty-seven times as long as wide; color cream white, head ferruginous yellow, prothorax yellow, mandibles brownish yellow to almost black, spines on legs brownish yellow.

Head (pl. 20, figs. *a*, *b*) elongate cylindrical, length exclusive of mandibles, twice diameter, sides subparallel, very highly polished. Front very narrow, sides almost parallel, diameter at middle about one-sixth diameter of head, extending to basal sixth of head, anteriorly dilated to attachment of clypeus; bears a pair of fine hairs near point where it is constricted. Clypeus quadrate, a little longer than broad, anterior angles membranous, anterior margin densely fringed with brush of fine hairs, emarginate and armed at middle with a highly chitinized bidentate prong; the dorsum bears four pair of short erect hairs. Antennæ slightly received in fossæ on dorsal surface of mandibles, very large, almost one-third length of head exclusive of mandibles; first joint clavate and but little longer than broad; second joint depressed, cylindrical, wider at distal extremity which is obliquely truncate, truncate surface bearing on inner part the very slender and rather short third joint and the accessory appendage, which latter is white and conical; the third joint is about as long as the first joint, cylindrical and three times as long as broad, it is slightly curved and directed at right angles to the long axis of the second joint. Mandibles (pl. 20, figs. *d*, *e*, *f*, *g*) are two-thirds the length of the head, biramous, and multidentate; the outer surface (pl. 20, fig. *e*) is slightly concave and each ramus bears two longitudinal carinæ; the inner surface (pl. 20, fig. *f*) of the dorsal ramus bears three stout acute teeth and two smaller teeth, the latter situated on each side of the lowest tooth; the ventral ramus is unarmed, at the base of the mandible on the inner surface is a broad oval molar area and a row of bristles continue the armature of the upper ramus. The submentum (pl. 20, figs. *a*, *c*) is almost obliterated, by the highly developed maxillary stipes, it is broadened at the anterior half but almost cut off from the mentum by the maxillary stipes which suddenly converge anteriorly, the submentum bears four hairs on its anterior part and a single pair at its posterior extremity; the mentum is elongate and clavate, and is adorned with a pair of median hairs near its distal end; the labial palpi are about half as long as the mentum, the first joint is twice as long as broad, the second is conical and one-third as long as broad; the maxil-

lary stipes are elongate and armed with nine stout spines on the lateral margins; the maxillary palpi are very stout and two-thirds as long as the stipes, the first joint is one and one-half times as long as broad, slightly clavate cylindrical, the second joint is one-quarter longer than broad, the third as long as broad and the fourth twice as long as broad and only half as wide as the third; the galea are two jointed, the first joint elongate and thickly beset with brushes of complex hairs, the second joint is clavate and bears four stout spines at its distal end; a second brush of hairs arises below the attachment of the galea and a third brush is situated on the under surface of the clypeus.

The first thoracic segment is nearly cylindrical and almost as long as the head exclusive of the mandibles, the second and third are subequal and about three-quarters as long as the first; the legs (pl. 21, fig. *d*) are very long and quite stout, the coxæ are as long as the femora and tibiæ united, and serve to receive these two joints when in repose; inner edge of coxæ bears a few long hairs; femora clavate and two-thirds as long as coxæ, tibia triangular, armed with three blunt stout spines near anterior margin, tarsus beset with one large scoop-shaped spine near the distal end, surrounded by four blunt spines and bearing three additional blunt spines along its inner side.

Abdomen with ten visible segments, segments two to seven are distinctly divided transversely into three distinct areas each, the anterior area of one segment being truncate conical and capable of being invaginated into the posterior area of the preceding segment when contracted, the middle area of each segment (pl. 21, fig. *b*) is globose, bears the ambulatory papillæ and the spiracles. Each segment bears two pair of ambulatory papillæ, a lateral pair anterior to the spiracles and a ventral pair near the anterior margin; each papillus is bilobed, and retractile; the spiracles are very obscure but of the typical biforian type; the tergite of each abdominal segment is marked by a median impressed line and a pair of shallow lateral grooves, the ventron of the middle area of each segment is divided into two parts by a median sulcus. The ninth abdominal segment (pl. 21, figs. *c*, *e*) is thimble-shaped and about as long as the middle section of the other abdominal segments; it bears at its extremity a rounded point which is armed with radially arranged stout spines. The tenth segment is concealed from above by the ninth, near the middle of the ventral side of which it arises, it is depressed cylindrical and directed obliquely ventrad; the anus is terminal and the anal lobes are arranged as follows.

The two lateral lobes are quadri-digitate and longer than the tenth segment, the ventral lobe is short and bidigitate, all these lobes are retractile.

The larva of *Horistonotus uhlerii* differs from that of *Cardiophorus asellus* and probably from all other species of this last genus, in the absence of ocelli. Schiodte has figured a large prominent ocellus at the base of each antenna. These ocelli are very

of Dr. Böving who assisted me in many ways in this investigation, I have been able to examine. They are quite absent from *H. uhlerii*.

The mandibles of *C. asselus* have a pair of stout teeth on the distal end, and two teeth on the inner face of each dorsal ramus, while in *H. uhlerii* the distal end of this ramus is rounded and the inner face bears three stout teeth with two smaller accessory teeth. The clypeus of *C. asselus* bears seven pair of dorsal hairs, while that of *H. uhlerii*, bears but four pair. The tibia of *C. asselus* is armed with two terminal spines, that of *H. uhlerii* with three, the tarsus of the former with one basal spine while the latter has three.

Schiödte in his classification says that the spiracles are tubular, this conclusion being probably drawn from their proximity to the lateral ambulatory papillæ, which are retractile; the spiracles are however of the true biforian type and are situated a little behind the papillæ, not on them.

I agree with Henriksen in believing that Schiödte was wrong in classifying this tribe with his subfamily Agrypninæ. He based his conclusions on a mistaken interpretation of the anal lobes. In his preserved specimen these are partly retracted so that they give the appearance of a membranous anal hook, which character he quite correctly used to limit his group Agrypninæ. I differ from Henriksen however, as he considers them in the subfamily Elaterinæ, in which subfamily the adults have always been placed. I believe the Cardiophorini of authors should at least be raised to equal rank with the other greater subfamilies of the Elateridæ (sensu stricto) and it may be eventually necessary to place this tribe in some higher ordinal catagory.

Explanation of Plates.

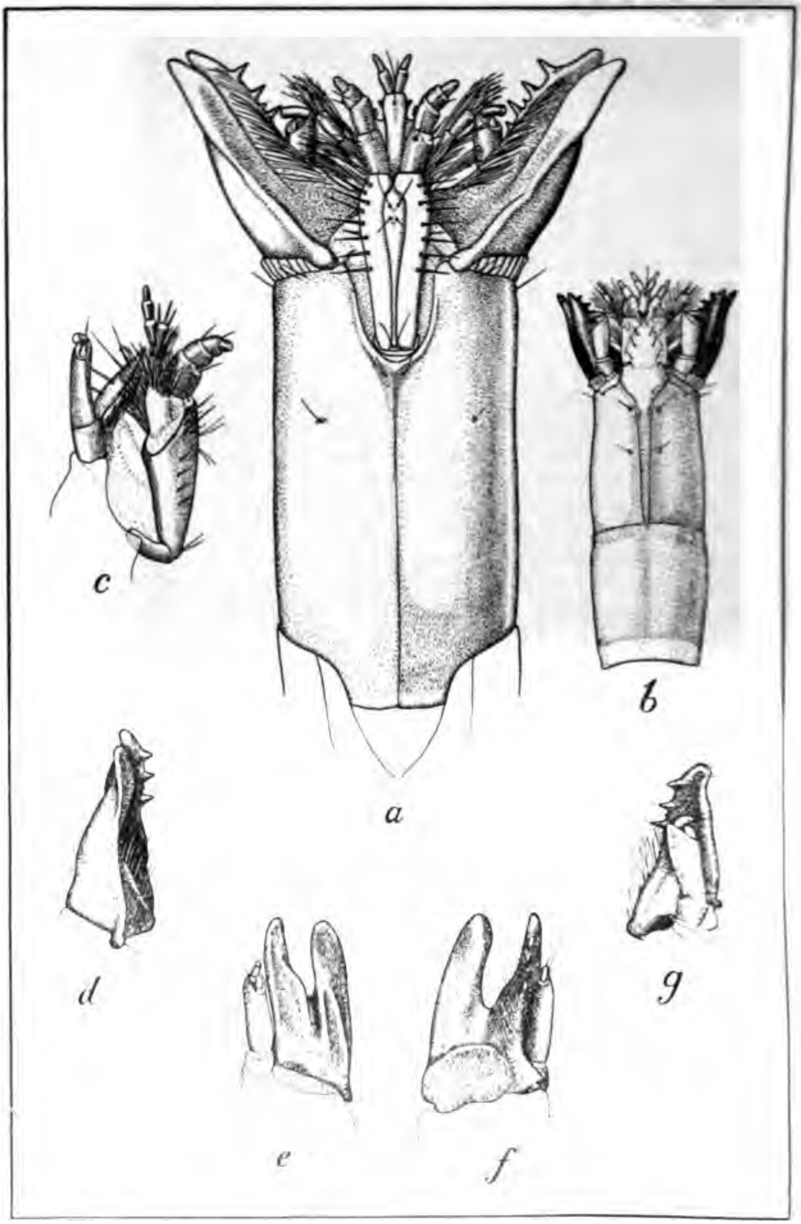
Horistonotus uhlerii Horn. (larva).

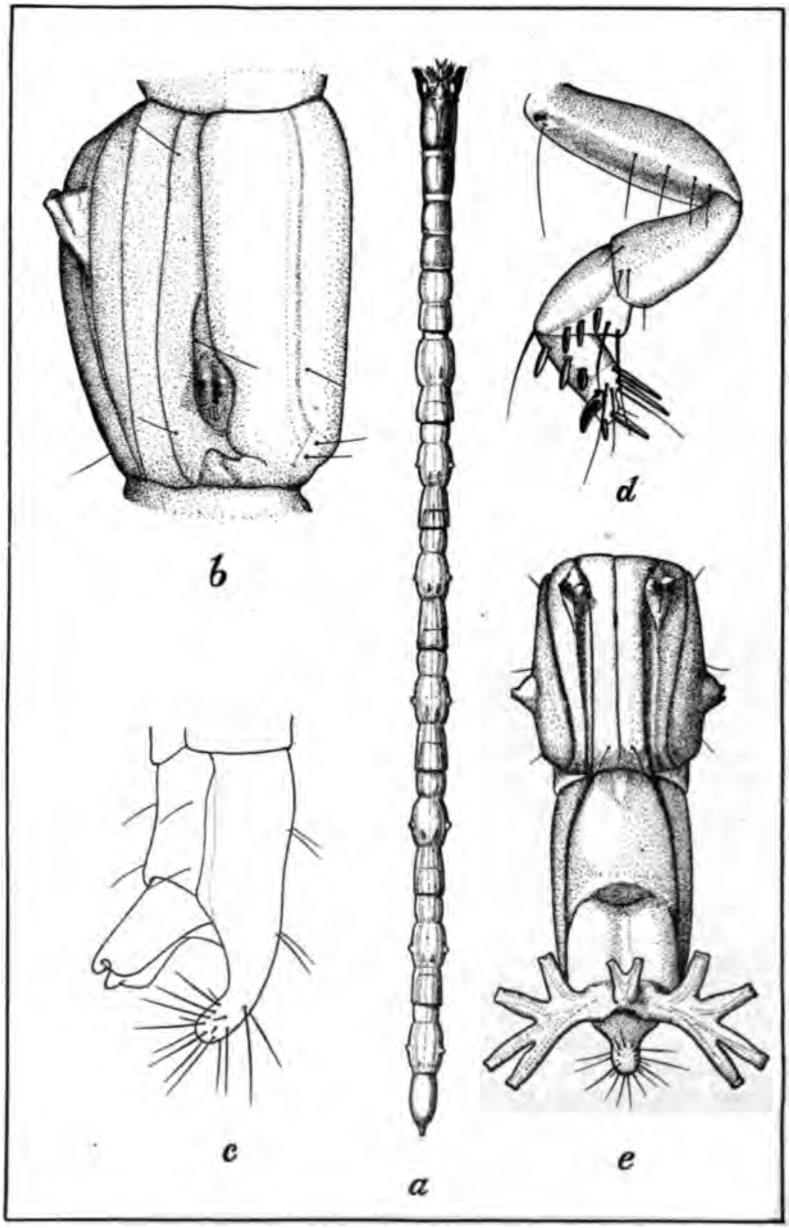
Plate XX.

Fig. a. Ventral aspect of head.
Fig. b. Dorsal aspect of head.
Fig. c. Lateral aspect of mouthparts, mandible removed.
Fig. d. Ventral aspect of right mandible.
Fig. e. Outer aspect of right mandible.
Fig. f. Inner aspect of right mandible.
Fig. g. Dorsal aspect of right mandible.

Plate XXI.

Fig. a. Dorsal aspect of larva.
Fig. b. Lateral aspect of middle part of fourth abdominal segment.
Fig. c. Lateral aspect of ninth and tenth abdominal segments.
Fig. d. Left mesothoracic leg.
Fig. e. Ventral aspect of eighth, ninth and tenth abdominal segments.


c
a
b
d
g
e
f


b
d
c
e
a

Under the heading of Notes and Exhibition of Specimens, the following were presented:

A NOTE IN REGARD TO TRICHODECTES HERMSI.

(*Mallophaga; Trichodectidæ*)

By Maurice C. Hall, *Bureau of Animal Industry*.

Kellogg and Nakayama have recently published in Psyche, v. 22, No. 2, April, 1915, a description of a new species of *Trichodectes* (*T. hermsi*), from the goat. The authors of this species say of *Trichodectes climax:* "It is the only *Trichodectes* until now found on the domestic goat." It seems safe to assume then that these writers follow Taschenberg in regarding *T. limbatus* and *T. capræ* as synonyms of *T. climax*. It seems, however, that they must have overlooked, at the time of publication, the case of *Trichodectes crassipes*, for they state in regard to *T. hermsi:* "It shows more of a resemblance, in shape and markings of head, and general appearance of body to *T. penicillatus* than to any other species of the genus, which resemblance, if it suggests any near relationship—it probably does not—is most extraordinary, as *penicillatus* has been recorded only from a kangaroo!"

The species *Trichodectes crassipes* was described by Rudow (1866) from the goat. Taschenberg (1882), on an examination of Rudow's material, stated it was identical with *T. penicillatus* from the kangaroo. Taschenberg states in comment that if one compares Rudow's and Piaget's figures he will regard this as quite impossible, since Rudow's figures are as inexact as his descriptions are noncommittal. It is interesting to note in this connection that Rudow's *T. crassipes* from the goat came from the Zoological Garden at Hamburg, and that Paiget's *T. penicillatus* from the kangaroo came from the Zoological Garden at Rotterdam. While one would be inclined to think under these circumstances that we were dealing with a habitual parasite of the kangaroo accidentally present on the goat, and assume that the parasites of the goat were well known, nevertheless the record of Kellogg and Nakayama suggests that there is, on the contrary a rather widely distributed goat parasite which has been reported once as an accidental parasite of the kangaroo.

It would not be safe to say positively at this time that *T. hermsi* was identical with *T. penicillatus*, although a comparison of the figures and descriptions shows only minor differences, and the fact that the resemblance has been noted by the authors of *T. hermsi*, and that *T. penicillatus* has been reported from the goat and the kangaroo in the opinion of Taschenberg and of

Railliet, and that Kellogg and Nakayama have apparently overlooked or forgotten this fact, all argue for the likelihood that *T. hermsi* is a redescription of *T. penicillatus*.

MACROSIAGON FLAVIPENNIS IN COCOON OF BEMBEX SPINOLÆ.

(*Coleoptera, Rhipiphoridæ*)

BY H. S. BARBER, *Bureau of Entomology*.

A fully matured specimen of this parasitic beetle was found by Mr. J. B. Parker in the still solid cocoon of a wasp (*Bembex spinolæ*), in a sand pile at Brookland, D. C., June 26, 1914, which I believe is the first host record of this species. Two other host records of the genus in North America are known to the writer, Lugger 1884 (Psyche, vol. 4, p. 211) being quoted as saying that the larva of *Tiphia* is often parasitized by a (*Rhipiphorus*) *Macrosiagon* (which statement was commented upon by Riley, l. c., p. 224) and Wolcott 1914 (Journ. Econ. Ent., vol. 7, p. 387) alluding to the parasitism of *Tiphia* cocoons by (*Rhipiphorus*) *Macrosiagon pectinatus* Fabr., and perhaps another species, in Missouri and Illinois, the details of the life-history not being known.

A most interesting account of a European species of this genus, *Emmenadia flabellata* Fabr. (this name now appearing in the Reitter catalogue as a synonym of *Macrosiagon ferruginea* Fab.), was published by Chobaut 1891 (Ann. Soc. Ent. Fr., vol. 60, pp. 447–456) in which the rearing of this parasite from the larvæ of *Odynerus* is recorded, and also the oviposition and first stage larvæ or triungulinids are described. This last writer cites and comments upon the account by Chapman 1870 (Ann. and Mag. Nat. Hist., vol. VI, 4 ser., pp. 314–326, pl. XVI) and Murray 1870 (l.c., pp. 326–328) of the life-history of *Metæcus paradoxus* (*Rhipiphorus*), parasitic in the nests of *Vespa vulgaris*.

Two species of *Rhipiphorus* (*Myodites* of our catalogs) have been recorded by Le Conte 1880 (Monthly Proc. Ent. Sec. Acad. Nat. Sci. Philadelphia, Dec. 13, 1880, p. XXIII) as parasitic, one on *Augochlora pura* and the other on *Nomia nevadensis* Cresson. [The determination of this latter is wrong, the insect being *Nomia pattoni* Ckll.]. Melander and Brues 1903 (Biol. Bull., vol. 5, No. 1, p. 26) suggest the parasitism of (*Myodites*) *Rhipiphorus fasciatus* Say on *Halictus pruinosus* Robertson. Pierce 1904 (Nebr. Univ. Studies, vol. 4, No. 2, pp. 153–189) records the oviposition of (*Myodites*) *Rhipiphorus solidaginis* in the flowers of *Solidago*, the transmission of the triungulinids to sunflowers by many different species of bees, where the real host,

Epinomia triungulifera Vachal, is attacked and carries them to its colonies.

Mr. Schwarz 1909 (Proc. Ent. Soc. Wash., vol. 10, p. 162–3) has already noted the occurrence of the roach parasite, *Rhipidius*, in coasting steamers to Central America.

EASTERN SYMPHOROMYIA ATTACKING MAN.

(*Diptera, Leptidæ.*)

By R. C. Shannon, *Bureau of Entomology.*

The blood-sucking habit of certain species of *Symphoromyia* has been repeatedly observed in the Rocky Mountain region, but there have been no records of this habit from eastern North America. While collecting on one of the thickly wooded islands below the Great Falls of the Potomac this spring (May 31, 1915), the writer noticed that small swarms of these flies would gather about him while he was moving about. When he remained quiet they would sometimes alight, most frequently upon his uncovered head. One alighted on his neck and started biting but was caught before she had imbibed any blood. The bite was quite as severe as that of *Chrysops*, while their flight was slower and the buzz lower. It was hoped that more would bite but they were very shy and would remain only a short time. Only six specimens were collected and they were kept alive until the following day when attempts were made to induce them to bite the writer's arm, but they refused and remained passive even when blood was supplied by pricking the skin. These flies were taken on a bright midday on the northern slopes of a rocky hillside which had been burnt over the preceding fall. In other localities of the same region only occasional specimens were taken.

These specimens are probably *Symphoromyia hirta* Johnson, although they do not agree in coloration with typical specimens. The antennæ and the legs, except the coxæ and the trochanters, are entirely yellow; the coxæ are black, dusted with cinereous, and the trochanters are shining, black. The size and all the other characters agree with *S. hirta.*

Besides the above mentioned specimens, the writer has collected one male and two females differing from the above mentioned ones in having the legs, except the knees, wholly black; the male from Virginia opposite Plummer's Island, Md., 18. V. 15; one female, Maryland opposite Plummers Island, 3. VI. 14, and the other female taken at Dead Run, Fairfax County, Va., 9. VI. 15. Five more females of the form with yellow legs were captured at

Dead Run, Fairfax County, Va., May 28, 1914, May 23, and June 9, 1915. Mr. Knab is of the opinion that these two forms are but color-variants of one species.

THREE INTERESTING ORTHOPTERA FROM THE VICINITY OF WASHINGTON, D. C.

By A. N. Caudell, *Bureau of Entomology.*

To our local fauna three species of Orthoptera are to be added. One, *Cryptocercus punctulatus* Scudder, was taken on Cupid's Bower Island, Md., a small island in the Potomac River some distance below Great Falls. Three specimens of this interesting roach have been taken, two by H. S. Barber on May 23 of the present year and one by R. C. Shannon on May 31. These roaches were taken in decayed pine logs. This species seems to be very local in occurrence but enjoys a wide distribution, ranging from the Atlantic to the Pacific and from Canada on the north, south to about the 34th parallel, the furthest southern record, I believe, being Rome, Georgia.

Another insect not at all common in the regions surrounding Washington is *Melanoplus collinus* Scudder. Numbers of both sexes of this grasshopper were taken at Great Falls, Virginia, on September 12, 1912. It occurred in some numbers in the open woods just below the picnic grounds at the Falls.

Melanoplus punctulatus Scudder occurs in pine woods and has been taken but once by me in the District, a single male near the upper reservoir north of Georgetown. A male was collected on Plummer's Island, Md., by Douglas Clemons on August 11, 1905 and the species has also been taken at Falls Church, Va.

MIGRATING ARMIES OF MYRIOPODS. (A CORRECTION).

By H. S. Barber, *Bureau of Entomology.*

Mr. R. V. Chamberlain of the Museum of Comparative Zoology has kindly examined specimens of the Myriopod from Humboldt Co., Cal., mentioned on pp. 121–122 of this volume but his reply was received after the number had gone to press. He writes that the specimens are immature and cannot be positively determined but belong to the leptodesmid genus *Chonaphe* and are probably *C. armata* (Harger.)

Two Hundred and Eighty-Eighth Meeting, October 7, 1915.

The 288th regular meeting of the Society was entertained by Mr. E. A. Schwarz at the Saengerbund Hall, October 7, 1915. There were present Messrs. Barber, Burgess, Caudell, Crawford, Ely, Gahan, Greene, Heinrich, Howard, Knab, Kotinsky, Marlatt, Middleton, Pierce, Quaintance, Rohwer, Sanford, Sasscer, Schwarz, Shannon, Turner, and Walton, members and Max Kisliuk, visitor.

The Corresponding Secretary presented a communication inviting the Society to send a delegate to participate in the deliberations of the Second Pan-American Scientific Congress to be held in Washington, D. C., December 27, 1915, to January 8, 1916. The Society named as delegate to the Congress, President A. N. Caudell; alternate, First Vice-president C. R. Ely.

Mr. Rohwer announced the death of Mr. H. M. Russell, a member of the Society and moved that a committee be appointed to draw up suitable resolutions. The motion prevailed and the President appointed as a committee Messrs. Quaintance, Hyslop, and Walton.

The following program was presented:

Parasitic Work of the Hawaiian Sugar Planters' Association.[1]
Dr. L. O. Howard

THE TACHINID FLY MAUROMYIA PULLA COQ. AND ITS SEXUAL DIMORPHISM.

By W. R. Walton,

U. S. Bureau of Entomology, Cereal and Forage Insect Investigations

In describing this fly[2] as the representative of a new genus and species Mr. Coquillett had before him but two specimens of the insect. These he considered as belonging to opposite sexes. Quite recently Mr. E. Daecke of Harrisburg, Penn., submitted to the writer several specimens of Tachinidae selected from a large series collected by himself at Carlisle Junction, Penn., which

[1] Withdrawn for publication elsewhere.
[2] Revision of the N. A. Tachinidae, p. 51

I believe to represent the undescribed male of *Mauromyia pulla* Coq., and, after a careful study of the material in the U. S. National Museum, I am convinced that Mr. Coquillett never saw the male of the species.

Since considerable dimorphism is apparent, especially in some characters which have been considered as of prime specific and even of generic index, it seems well to describe the male and also to note some of the more remarkable variations in structure peculiar to this rather extraordinary form.

Mauromyia pulla Coq.

Male. Head (fig. 1, *1.*) quadrangular in side elevation, its anterior border distinctly concave. Cheeks nearly as wide as eye-height. Inferior occiput swollen. Front produced directly forward, not sloping downward to base of antennæ. First antennal joint unusually long, fully as long as second, produced upward at an angle of 45°, its tip projecting distinctly above the level of the front. Third antennal joint five times as long as second, distinctly short pilose, its lower three-fourths strongly concave on anterior border. Arista thickened on at least the basal three-fourths, first joint slightly longer than broad, second joint at least three times as long as broad. Facial ridges bristly on lowest third. Vibrissæ multiple, the larger pairs subequal, not cruciate, situated on oral margin. Facial depression enormous in width, nearly twice as wide as in female; genovertical plates at narrowest part not more than one-fifth its maximum width. Eyes small, bearing sparsely scattered hairs visible only upon minute examination. Frontal bristles descending to base of arista, the uppermost pair pointing distinctly outward. Front one and one-half times width of eye, vitta occupying considerably more than one-half width of front, brown. Sides of front cinereous, pollinose sprinkled with coarse black hairs; orbital bristles absent. Face on lower half bearing two or more irregular rows of small macrochætæ, the lowest ones reaching below lower border of eye. Ocellar bristles rather weak, directed forward, the postocellar pair well developed and directed vertically. Wings brownish hyaline, broad, rather short, costal spine obsolete. Apical cell long-petiolate, ending very slightly before wing tip. Bend of fourth vein variable, forming an angle of 45° in some specimens (fig. 1, *2*), in others bent considerably inward in a distinct curve (fig. 1, *3*). A short stump present or occasionally entirely absent. The longitudinal and cross veins bordered with a light but distinct brownish stain. Hind cross-vein usually bisinuate. Sterno-pleural macrochætæ varying in arrangement and number from two to five. Abdomen flattened ovate, slightly more slender than in female but otherwise quite similar. First segment bearing a weak marginal pair, the remaining segments with both discal and marginal macrochætæ. Hypopygium prominent, bent forward, its basal ring shining black, the remainder nearly opaque.

The female differs as follows: in the very much shorter antennæ, length of second aristal joint (figs. 1, *1a*, *1b*), shape and extent of facial depression, extent of thickening of arista (figs. 1, *1a*, *1b*), presence of orbital bristles, absence of discal and sometimes marginal bristles of abdominal segments.

These facts show how inadvisable is the practice of proposing genera upon scanty material representing but one sex.

Mr. Daecke, to whom I am indebted for specimens and notes, states the flies were taken in large numbers from the trunk of

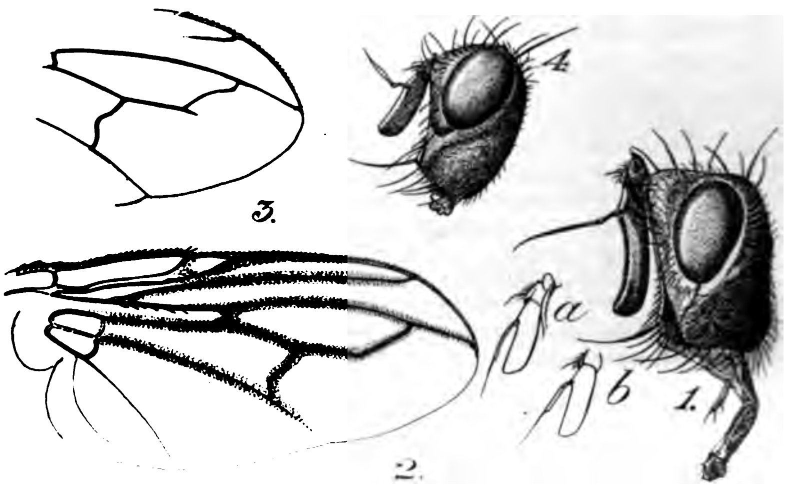


Fig. 1. *Mauromyia pulla* Coq.

1. Head of male lateral view. 1a. Antenna of female showing elongate second aristal joint. 1b. Antenna of another female showing second aristal joint abbreviated. 2. Wing of male showing bend of fourth vein destitute of appendage. 3. Wing of another specimen of same sex with the bend appendiculate and the vein beyond bent inward.

4. Head of male *Paradmontia brevis* Coq.

a tree about which they were running with the prominent antennæ held in a porrect position. Mr. Chas. T. Greene has also loaned specimens, both male and female, which have been of much value in the study of the species. These were collected at Lehigh Gap, Penn.

Some doubt has heretofore existed regarding the distinctness of the two species, *Mauromyia pulla* Coq. and *Paradmontia brevis* Coq., although the former has a bare and the latter a bristly first longitudinal vein. This uncertainty is now happily elimi-

nated by the discovery of the male of *Mauromyia pulla*. A drawing of the head of *Paradmontia brevis* (fig. 1, *4*) is provided herewith for the purpose of comparison.

DUNG-BEARING WEEVIL LARVÆ.

By Frederick Knab, *Bureau of Entomology.*

The habit of covering themselves with a coating of their own excrement occurs in the larvæ of several genera of Chrysomelidæ. Of these *Blepharida* and certain species of *Lema* and *Crioceris* are familiar examples. No such habit has been recorded for the weevils and its occurrence is the more remarkable when one considers that in this group but a small proportion of the species have externally feeding larvæ. The writer has observed the dung-carrying habit in the larvæ of two species of Ceutorhynchini, *Cœlogaster lituratus* Dietz and *Perigaster obscurus* LeConte.

The first observation was made in 1902. On August 5 of that year Mr. J. O. Martin and the writer were collecting on the slopes of Mount Holyoke, Massachusetts. Mr. Martin called my attention to some small groups of larvæ of different sizes on the leaves of a plant of *Œnothera biennis*. The larvæ were of the characteristic form of those of *Lema*, robust and much thickened medially, and were covered with moist dung. The color of the body was a pale translucent yellowish tint and the head was reddish brown. The body was covered with a slimy secretion in which the excrement was imbedded and this latter was distributed so well that only the prominent lateral callosities were visible. The slimy secretion probably is a product of the malpighian tubes.[1] The larvæ were kept alive for rearing and on August 8 the largest of them had enclosed themselves in cocoons of dry dung. The body of the larva, now divested of its coating of slime and dung, had changed to opaque yellow and the head showed a brighter ferruginous tint. The pupæ were bright yellow. The beetles reared from this material were kindly determined by Dr. W. G. Dietz as *Cœlogaster lituratus* Dietz.

The following year, 1903, on July 14, Dr. Geo. Dimmock again found the larvæ in the vicinity of Westfield, Mass., and as before on *Œnothera*. Some of these larvæ were reared and produced imagos of the same species. Others of the larvæ were boiled in alcohol, for preservation, and it was found that the thick coating of slime hardened and detached in the form of a shell which still retained the imbedded excrement.

---

[1] See discussion of the secretions of weevil larvæ, this volume, pages 154–158.

Dung-bearing weevil larvæ were again found on September 1 and 14, 1912, at Hyattsville, Md. In this case the food-plant was *Ludwigia alternifolia* L., a plant closely related to *Œnothera*. The beetles reared from these larvæ were determined by Mr. W. D. Pierce as *Perigaster obscurus*. The larvæ usually occurred singly on a leaf and but a small number on the same plant. They were mostly on the under side of the leaves, though occassional ones occurred on the upper side. They ate elongate holes into the leaves, or pieces out of their sides. Most specimens of the food-plant, scattered over the open, wet gravelly ground, showed the work of the larvæ. On September first the larvæ were abundant and of various sizes, but two weeks later larvæ could only be found on three plants and these were all full-grown or nearly so.

As in the case of *Cœlogaster lituratus*, the larvæ were entirely covered dorsally with their own excrement imbedded in a secretion from the anus. The secretion flows down the sides and gives the entire larva, excrement included, a shining appearance. As in *Cœlogaster*, the larva is short and stout, high medially, the body-segments forming a series of strongly convex ridges which are tuberculately produced at the sides; from these tubercles the spiracles project like minute papillæ. The color of the body of the larva is dull creamy yellow, its head pale ferruginous. The excrement is nearly black and the secretion brownish yellow, the latter probably being stained by the excrement. The excrement is carried forward from the anus by peristaltic movements of the body segments, which are particularly violent posteriorly. The result is that the excrement accumulates on the anterior portion of the larva and there overhangs the head, as well as extending down the sides.

When about to pupate the larva gets rid of its covering and shapes it into a cocoon. At this time the larva is opaque bright yellow; the pupa is of the same color. Larvæ kept in close confinement in a tin box did not always succeed in shaping a cocoon. When they came in contact at this time the secretion caused them to stick together and they appeared unable to free themselves. Of the larvæ brought home September first, a number had transformed to beetles by September 8 and the remainder issued within a few days after. The larvæ probably normally pupate on the ground. No trace of the pupæ could be found in nature, except a single cocoon upon the upper side of a leaf of the food-plant near the ground. This plant stood in a very wet place, where there must have been water two or three days earlier.

THE MATING HABITS OF SOME SAWFLIES.

By S. A. Rohwer, *Branch of Forest Insects, Bureau of Entomology.*

There is very little information concerning the mating habits of sawflies published and it is believed that the following observations are worth recording. Especially is this true if the writer's belief, that the value of a character cannot be properly rated until its function or relation to the life cycle of the species is understood, can be considered feasible. Taxonomists of sawflies have so far paid very little attention to the male genitalia, but when these parts are used for taxonomic purposes it is very probable that in many groups it will be found that the concavity-shape and structure of the cochlearium will offer valuable characters. The shape and length of the penis and preputium will offer other useful characters.

The terminology of the male genitalia used in this paper is that given by Hartig in "Die familien der Blattwespen und Holzwespen" Berlin, 1860.

Fig. 1. *Xiphydria maculata* Say. Male and female in coitu. (Drawing by Wm. Middleton.)

XIPHYDRIA MACULATA SAY.

This species emerges early in the spring and from the notes available it would seem that every female mates. The notes on copulation presented here are summarized from many observations. In no case was there any courting and mating usually occurred whenever two sexually active individuals of opposite sexes came in close promixity. There is a great variation in size of individuals of this species but, as far as the observations went, size played no part in determining whether two individuals would mate.

In copulation the male rides on the back of the female curving the tip of his abdomen under the tip of her abdomen so the cochlearii of the extended genitalia grasps the side of the knob at the base of the sheath and the hypopygidium fits over the knob. The use of the preputium and penis was not observed. During copulation which lasts about 90 seconds there is a contraction and expansion of the muscles of the stipes so there is a strong push and pull motion. The wings are held flat against the body. The legs of the female are placed in the usual position assumed when resting, i.e., the fore legs directed anteriorly, the middle legs almost at right angles, the hind legs slightly posteriorly. The antennæ may be held still or waved slightly.

DIPRION LECONTEI (FITCH).

These notes dealing with the mating habits of *Diprion lecontei* are summarized from extensive notes on this species which have been accumulated at the Eastern Station of Branch of Forest Insects, and the material used came from localities covering most of the range of the species although most of the detailed notes were made on material collected near Falls Church, Va.

In the life history of this species there are some interesting and unusual conditions. The one which concerns this paper may be summarized as follows: In the first generation mating is the rule while in the second it is exceptional. In localities where there is only one generation mating normally occurs and there is a preponderance of males; in localities where there are two or more generations mating occurs normally only during the first, but in such localities mating may be witnessed throughout most of the season because of the great overlapping of generations. There is no courtship in this species, and the females of the first generation take as active a part in finding a mate as does the male while the females of the second generation will fight and may kill a male rather than mate. During copulation the wings are held flat against the body, the legs are spread rather far apart, the fore legs projecting anteriorly, the middle slightly anteriorly and the hind posteriorly, the antennæ are usually moved slowly up and down.

Copulation lasts about 100 seconds and is accomplished by the two individuals facing in opposite directions and the extreme end of the male abdomen being bent at an obtuse angle because of the truncate abdomen of the female. The hypopygidium of the male fits over the knob at the base of the sheath, the cochlearii grasp the sides of the knob in the manner of a ball and socket joint while the position occupied by the preputii and penis was not observed although they are probably used as in *E*[illegible]

EUURA MACGILLIVRAYI ROHWER.

The notes on the mating of *Euura macgillivrayi* were made from a number of males and females which issued from galls collected in the type locality by Frank W. Rohwer. In this species there is no real courtship, but when individuals have freshly emerged and are sexually active they are more excited when in close proximity with an individual of opposite sex, as is evidenced by the rapid movement of antennæ and wings. There is, however, very little evidence of a positive power of recognizing the opposite sex because occasionally a male would seize another male or more rarely a female would seize another female. Unlike certain other insects the female of this species takes as active a part in looking for her mate as does the males as is proven by the fact that in a number of instances a female would seize and endeavor to mate with a tired male. In some few instances one female mated with two different males but as far as the observations went no male mated more than once. During copulation the wings are held close against the body or but slightly above it; the legs are spread rather far apart, the fore extending anteriorly, the middle at right angles with the body and the hind distinctly posteriorly.

Copulation occupies about 65 seconds and is accomplished by the two individuals facing in opposite directions. The hypopygidium of the male extends over the knob at the base of the sheath, the cochlearii grasp the sides of the knob after the fashion of a ball and socket joint, while the preputii and penis are inserted in the opening at the base of the sheath. When mating is completed the female endeavors to free herself of the male by using the hind legs and saw or if unsuccessful at first the sheath is used. There is apparently no expansion or contraction of the muscles of the stipes. After mating both sexes "dress" their abdomen with their hind legs.

PTERONIDEA VENTRALIS (SAY).

I have never had an opportunity to observe the mating of this species, and the notes here given are taken from a pair captured in coitu (and remaining connected) by C. T. Greene at Plummer's Island, Md., July 2, 1912, and from pictures taken at Plummer's Island, Md., by H. S. Barber. Mr. Barber's photographs are very interesting and would lead one to infer that the female of this species may mate more than once and with different individuals. From the attitude assumed by the male in figure 1 of plate XXII it is evident that the male is more excitable than the female.

From the pair secured by Mr. Greene the position assumed by certain parts of the genitalia may be described as follows: The hypopygidium fits over the knob at the base of the sheath while the cochlearii grasp the side of the same knob in the manner of a ball and socket joint. The position of the other parts cannot be seen.

HYPARGYRICUS FUMIPENNIS (NORTON).

Mr. J. C. Crawford captured a pair of this species in coitu on Plummer's Island, Md., April 22, 1915, and notes that they were facing in the opposite directions.

EXPLANATION OF PLATE XXII.

Pteronidea ventralis (Say). A and B—Two perfect individuals, male and female, mating. C, D and E—female which has lost her flagelli being "courted" by three males. In D and E the female is mating with the male at the left. (Photographs by H. S. Barber at Plummer's Island, Md., on leaves of *Salix niger*).

AMETASTEGIA GLABRATA (FALLÉN), A HOLARCTIC SAWFLY.

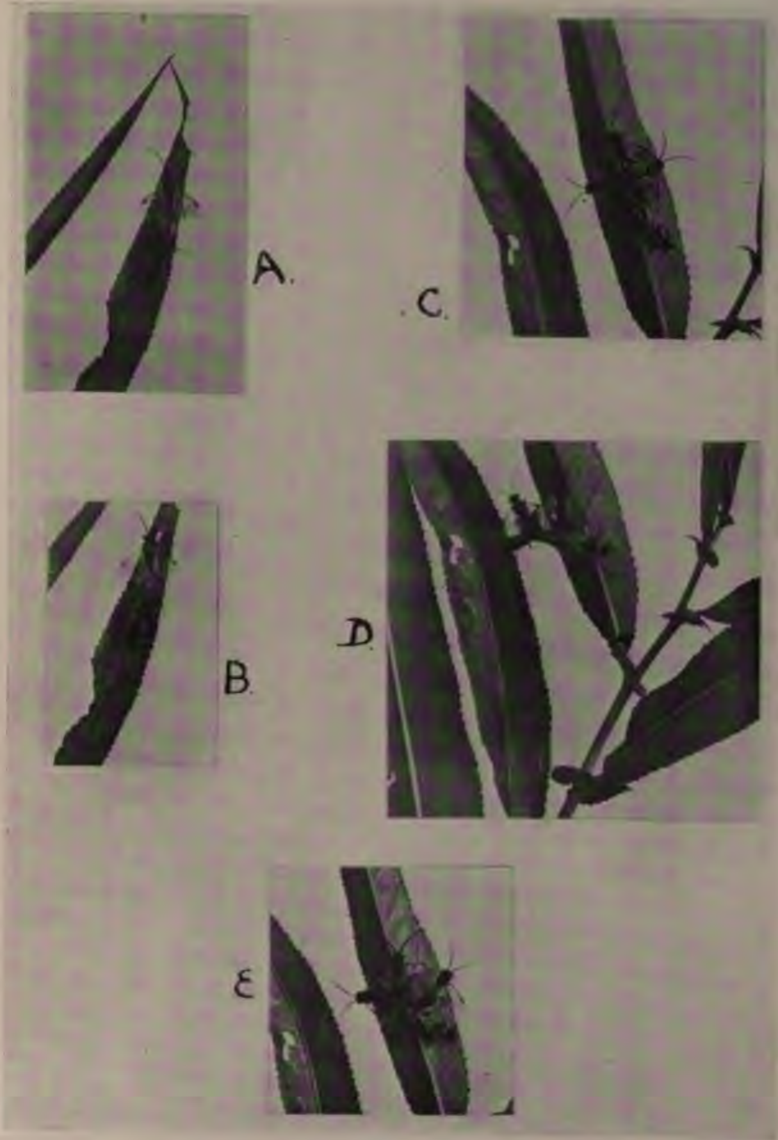
By S. A Rohwer

Branch Forest Insects, Bureau of Entomology, Washington, D. C.

The "dock sawfly," *Ametastegia glabrata* (Fallén), has been known in America for many years and has heretofore been considered as a native species. Whether it is a native holarctic species or whether it was introduced from Europe may never be decided, but it is very certain that the American and European specimens are morphologically identical and inasmuch as they have the same habits it is believed the following synonymy is justifiable. The European synonymy is copied from Enslin.

AMETASTEGIA GLABRATA (FALLÉN).

Tenthredo glabrata Fallén, Svensk. Vet. Akad. Handl. 1808, p. 108.
Tenthredo (Allantus) agilis Klug, Magaz. Ges. Naturf. Fr. Berlin, VIII 1814, p. 208.
Tenthredo (Allantus) rufipes Lepeletier, Monog. Tenthred. 1823, p. 81.
[illegible] A. Costa, Rend. Acad. Sc. Napoli, vol. 21, 1882, p. 198
[illegible] Norton, Proc. Boston Soc. Nat. Hist., vol. 9, 1862, p. [illegible]; Tr. Amer. Ent. Soc., vol. 2, 1868, p. 165; Provancher, Nat. Can., vol. 10, 1878, p. 165; Faune ent. Canad., Hym. 1883, p. 214; [illegible]


A.
B.
C.
D.
E

Can. Ent., vol. 25, 1893, p. 183; Chittenden and Titus, Bul. 54, U. S. D. A. Bur. Ent. 1905, p. 40–43; Fletcher, 33d Ann. Rept. Ent. Soc. Ontario 1902 (1903) p. 86; 34th l. c. 1903 (1904), p. 70; Harrington, 33d Ann. Rept. Ent. Soc. Ontario 1902 (1903), p. 100; Webster, R. L., Jn. Econ. Ent., vol. 1, 1908, p. 310.

Strongylogaster abnormis Provancher, Addit. fauna Can. Hym. 1885, p. 10; Dyar, Tr. Amer. Ent. Soc., vol. 25, 1895, p. 311–312; Can. Ent., vol. 27, 1895, p. 340; Jn. N. Y. Ent. Soc., vol. 5, 1897, p. 199.

TWO NEW SPECIES OF SIMULIUM FROM TROPICAL AMERICA.

By Allan H. Jennings, *Bureau of Entomology.*

During 1913 a commission headed by Dr. Louis W. Sambon was sent from England to the West Indies and adjoining regions to investigate pellagra and its manner of transmission. Through invitation the writer was able to accompany this expedition with the special object of investigating the insects that might have a bearing on the transmission of the disease. Special attention was given to *Simulium* and among the material collected were the two new species described below. I am much indebted to Mr. Knab for assistance in this connection. Details of the biology of these species will be published in another place.

Simulium samboni new species.

Female. Occiput, frons and face black, densely light silvery gray pollinose. Antennæ rather stout, brownish yellow, darker distally, the first two joints honey yellow and smooth, the others clothed with short whitish pile. Palpi blackish. Mesonotum bright orange-ferruginous, with four narrow, pollinose, grayish-silvery stripes, the outer ones at the lateral margins, the inner pair sinuate, extending nearly to the scutellum and dividing the disk into three nearly equal parts; vestiture of fine, evenly distributed golden hair-scales not forming regular series. Scutellum paler than mesonotum, honey yellow; transverse hair-scales on the disk golden, the marginal bristles black. Postnotum ferruginous. Pleuræ ocher-yellow, strongly infuscated on the mesosternum. Abdomen subcylindrical, black and gray; segments 2 to 5 black and with the margins and two longitudinal stripes gray, thus delimiting three series of large black spots; sixth segment shining, mostly gray. Anterior coxæ yellow, the others infuscated. Legs bright ocher-yellow, the hind pair with the apices of the femora infuscated and the distal halves of the tibiæ blackish, their basal halves with whitish luster; front tarsi blackish, the first joint tinged basally with luteous; mid tarsi with the first joint pale, its distal fourth blackish, the second joint pale on basal half, the last three joints wholly blackish; hind tarsi with the first joint pale, infuscated along its lower margin and on apical third, the second joint pale on basal half, the last three joints wholly blackish; appressed hair-scales partly pale and partly black, in correspondence with the ground-color. Claws simple, thickened at base. Wings hyaline, the venation normal; thick veins pale yellow; anal field without iridescent spot. Halteres pale yellow. Length: Body about 1.5 mm., wing 2 mm.

Male. Holoptic. Antennæ much more slender than in the female. Mesonotum strongly convex, the silvery pollinose ornamentation reduced to two short wedge-shaped spots at anterior margin and visible only in certain lights.

Empire, Canal Zone, Panama, reared from pupæ taken from a small tributary of the Comacho River, October 4, 1913 (A. H. Jennings).

Type: Cat. No. 19996, U. S. Nat. Mus.

It gives me pleasure to dedicate this handsome species to Dr. Louis W. Sambon.

Simulium antillarum new species.

Female. Occiput, frons and face black, densely light silvery gray pollinose; frons moderately broad, but very slightly narrowed anteriorly, nearly parallel-sided. Antennæ rather short, the first two joints ferruginous and nude, the following ones blackish brown and clothed with short whitish pile. Palpi black. Mesonotum bright orange-ferruginous, the region of the humeri and the lateral margins ochreous yellow, a narrow, wedge-shaped dark spot at the lateral suture in front of insertion of wings; on the anterior half two narrow silvery white pollinose stripes, nearly equidistant from each other and from the lateral margins; these stripes are nearly straight, tapered anteriorly and do not reach the anterior margin; vestiture of very fine, evenly distributed black hairs not forming regular series. Scutellum more yellowish than mesonotum, with transverse yellowish hairs on the disk and a series of marginal black bristles. Postnotum ferruginous. Pleuræ ochreous yellow, with some silvery pollinose streaks and with the mesosternum strongly infuscated. Abdomen shining, blackish, tinged more or less with yellow-brown basally and distally, the apical margins of the segments very narrowly pale. Anterior coxæ yellow, the others infuscated. All the femora yellow; tibiæ more or less infuscated, the middle pair lightest, the posterior pair nearly black; tarsi blackish; femora with yellowish hair-scales, tibiæ and tarsi mostly with black hairs. Claws simple, thickened at base. Wings hyaline, the venation normal, the costa infuscated and densely black spinulose, the other thick veins yellowish, a minute dark spot on the crossvein; a large but rather faint reddish iridescent area in the anal field. Halteres pale yellowish. Length: Body about 1.5 mm., wing 2 mm.

Male. Holoptic. Antennæ much more slender than in the female. Mesonotum strongly convex, the two silvery pollinose marks shorter and broader. Abdomen slender, the first four segments ocher-yellow, the succeeding ones black.

St. Croix, Danish West Indies, November, 1913; Hope River near Kingston and Roaring River close to the falls, Jamaica, September, 1913 (A. H. Jennings).

Type: Cat. No. 19997, U. S. Nat. Mus.

The material was mostly reared from pupæ occurring in rapid streams in the above named localities. In St. Croix, on November 24 and close by their breeding-place, two specimens were captured while biting man.

Actual date of publication December 31, 1915.

INDEX TO VOLUME XVII

ERRATUM

Page 55, line 3 from bottom, for "Vol. V, no. 1, 1902," read "Vol. VII, nos. 2-3, 1906."

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVI, No. 1

MARCH, 1914

PUBLISHED QUARTERLY BY THE SOCIETY
OFFICE OF PUBLICATION
2419-21 GREENMOUNT AVE.
BALTIMORE, MD.

EDITORIAL OFFICE
WASHINGTON, D. C.

Entered as second-class matter at the postoffice at Baltimore, Md., February 28, 1913, under the Act of August 24, 1912

TABLE OF CONTENTS FOR THIS NUMBER

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVI, No. 2

JUNE, 1914

PUBLISHED QUARTERLY BY THE SOCIETY

OFFICE OF PUBLICATION
2419-21 GREENMOUNT AVE
BALTIMORE, MD.

EDITORIAL OFFICE
WASHINGTON, D. C.

Entered as second-class matter at the postoffice at Baltimore, Md., February [illegible], 1913,
under the Act of August [illegible], 1912

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884.

The regular meetings of the Society are held on the first Thursday of each month, from October to June inclusive, at 8 P. M.

Annual dues of active members, $3.00; of corresponding members $2.00; initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1914.

President.......................................W. D. HUNTER
First Vice-President...............................A. N. CAUDELL
Second Vice-President..............................E. R. SASSCER
Recording Secretary................................W. R. WOOD
Corresponding Secretary-Treasurer..................S. A. ROHWER
U. S. National Museum, Washington, D. C.
Editor..W. D. HUNTER
Representing the Society as a Vice-President of the Washington Academy of Sciences..........A. L. QUAINTANCE

Executive Committee.

THE OFFICERS.

AUGUST BUSCK. E. A. SCHWARZ. L. O. HOWARD.

PROCEEDINGS
ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published quarterly by the Society at Baltimore, Md., and Washington, D. C. Terms of subscription: Domestic, $2.00 per annum; foreign, $2.25 per annum; single numbers, 50 cents, foreign postage extra. Remittances should be made payable to the Entomological Society of Washington.

Authors of leading articles in the PROCEEDINGS will be entitled to 25 separates of each contribution, free of charge. Additional copies may be had at 50 per cent more than cost by notifying the Editor before the first page proof is returned to the printer.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON
1884

VOLUME XVI, No. 2
JUNE, 1914

Published Quarterly by the Society
OFFICE OF PUBLICATION
[illegible]
BALTIMORE, MD.

EDITORIAL OFFICE
WASHINGTON, D. C.

[illegible]

TABLE OF CONTENTS FOR THIS NUMBER

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVI, No. 3

SEPTEMBER, 1914

PUBLISHED QUARTERLY BY THE SOCIETY

OFFICE OF PUBLICATION
2419-21 GREENMOUNT AVE.
BALTIMORE, MD.

EDITORIAL OFFICE
WASHINGTON, D. C.

Entered as second-class matter at the postoffice at Baltimore, Md., February 25, 1913, under the Act of August 24, 1912.

each month, from October to June inclusive, at 8 P. M.

Annual dues of active members, $3.00; of corresponding members $2.00; initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1914.

President .... W. D. HUNTER
First Vice-President .... A. N. CAUDELL
Second Vice-President .... E. R. SASSCER
Recording Secretary .... W. B. WOOD
Corresponding Secretary-Treasurer .... S. A. ROHWER
U. S. National Museum, Washington, D. C.
Editor .... W. D. HUNTER
Representing the Society as a Vice-President of the Washington Academy of Sciences .... A. L. QUAINTANCE

Executive Committee.

THE OFFICERS.

AUGUST BUSCK. E. A. SCHWARZ. L. O. HOWARD.

PROCEEDINGS

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published quarterly by the Society at Baltimore, Md., and Washington, D. C. Terms of subscription: Domestic, $2.00 per annum; foreign, $2.25 per annum; single numbers, 50 cents, foreign postage extra. Remittances should be made payable to the Entomological Society of Washington.

Authors of leading articles in the PROCEEDINGS will be entitled to

ANNOUNCEMENT

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVI, No. 4

DECEMBER, 1914

PUBLISHED QUARTERLY BY THE SOCIETY
OFFICE OF PUBLICATION
2419-21 GREENMOUNT AVE.
BALTIMORE, MD.

EDITORIAL OFFICE
WASHINGTON, D. C.

Entered as second-class matter at the postoffice at Baltimore, Md., [illegible], 1913, under the Act of August 24, 1912

Annual dues of active members, $3.00; of corresponding members [illegible]
Initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 191[illegible].

President .... W. D. HUNT[illegible]
First Vice-President .... A. N. CAU[illegible]
Second Vice-President .... E. R. [illegible]
Recording Secretary .... W. R. WO[illegible]
Corresponding Secretary-Treasurer .... S. A. RO[illegible]
U. S. National Museum, Washington, D. C.
Editor .... W. D. HUNT[illegible]
Representing the Society as a Vice-President of the Washington Academy of Sciences .... A. L. QUAINTA[illegible]

Executive Committee.

THE OFFICERS.

AUGUST BUSCK. E. A. SCHWARZ. L. O. HOWA[illegible]

PROCEEDINGS
ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published quarterly by the Society at Baltimore, Md., and Wash[illegible]ington, D. C. Terms of subscription: Domestic, $2.00 per an[illegible] foreign, $2.25 per annum; single numbers, 50 cents, foreign [illegible] extra. Remittances should be made payable to the Entomolog[illegible]

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVI, No. [illegible]

DECEMBER, 1914

PUBLISHED QUARTERLY BY THE SOCIETY

OFFICE OF PUBLICATION

[illegible]

BALTIMORE, MD.

EDITORIAL OFFICE

WASHINGTON, D. C.

[illegible]

Annual dues of active members, $3.00; of corresponding members
initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1915.

President..A. N. CAU
First Vice-President...C. L.
Second Vice-President..E. R. SAS
Recording Secretary..A. B. G
Corresponding Secretary-Treasurer................................S. A. ROH
U. S. National Museum, Washington, D. C
Editor...J. C. CRAWF
Representing the Society as a Vice-President of the Washington Academy of Sciences..........W. D. HUN

Executive Committee.

THE OFFICERS.

E. A. SCHWARZ. A. L. QUAINTANCE. C. L. MA

PROCEEDINGS

ENTOMOLOGICAL SOCIETY OF WASHINGTON

Published quarterly by the Society at Baltimore, Md., and W
ington, D. C. Terms of subscription: Domestic, $2.00 per an
foreign, $2.25 per annum; single numbers, 50 cents, foreign po
extra. Remittances should be made payable to the Entomol
Society of Washington.

Authors of leading articles in the PROCEEDINGS will be entitled

ANNOUNCEMENT

Separates of all the important papers published in the PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON and a number from other journals are for sale at approximately two cents per page (no article less than ten cents). They can be had by applying to the Corresponding Secretary of the Entomological Society, U. S. National Museum, Washington, D. C. No receipt will be mailed for the sale of printed matter unless especially requested.

OF SPECIAL INTEREST

BAKER, C. F. A Revision of the North American Siphonaptera or Fleas, Together with a Complete List and Bibliography of the Group. 1904 .... $1.50

BANKS, N. Bibliography of the More Important Contributions to American Economic Entomology. 1888–1905. Parts 6, 7, 8 .... $1.50

DYAR, H. G. The Life Histories of the New York Slug Caterpillars. Journ. New York Ent. Soc. 1895–1899. (Complete) $1.50

DYAR, H. G. Life Histories of North American Geometridae. Psyche, 1899–1905, 63 parts (part 20 missing) $ .75

HEIDEMANN, O. Some Remarks on the Eggs of North American Species of Hemiptera-Heteroptera. 1911 $ .25

SMITH, J. B. Contribution Toward a Monograph of the Noctuidae of Temperate North America.—Five parts, Mamestra, Xylophasia and Superina, Some Taeniocampid genera; Homohadena, Agrotes. (May be had separately) Set $2.25

The regular meetings of the Society are held on the first Thursday of each month, from October to June inclusive, at 8 P. M.

Annual dues of active members, $3.00; of corresponding members $2.00; initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1915.

President .... A. N. CAUDELL
First Vice-President .... C. R. ELY
Second Vice-President .... E. R. SASSCER
Recording Secretary .... A. B. GAHAN
Corresponding Secretary-Treasurer .... S. A. ROHWER
U. S. National Museum, Washington, D. C.
Editor .... J. C. CRAWFORD
Representing the Society as a Vice-President of the Washington Academy of Sciences .... W. D. HUNTER

Executive Committee.

THE OFFICERS.

E. A. SCHWARZ. A. L. QUAINTANCE. C. L. MARLATT.

PROCEEDINGS

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published quarterly by the Society at Baltimore, Md., and Washington, D. C. Terms of subscription: Domestic, $2.00 per annum; foreign, $2.25 per annum; single numbers, 50 cents, foreign postage

ANNOUNCEMENT

parates of all the important papers published in the PROCEED- OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON and a num- rom other journals are for sale at approximately two cents per (no article less than ten cents). They can be had by apply- o the Corresponding Secretary of the Entomological Society, National Museum, Washington, D. C. No receipt will be d for the sale of printed matter unless especially requested.

OF SPECIAL INTEREST

er, C. F. A Revision of the North American Siphonaptera or Fleas, Together with a Complete List and Bibliography of the Group. 1904	$1.50
s, N. Bibliography of the More Important Contributions to American Economic Entomology. 1888–1905. Parts 6, 7, 8	$1.50
, H. G. The Life Histories of the New York Slug Caterpillars. Journ. New York Ent. Soc. 1895–1899. (Complete)	$1.50
s, H. G. Life Histories of North American Geometridae. Psyche, 1899–1905, 63 parts (part 20 missing)	$ .75
EMANN, O. Some Remarks on the Eggs of North American Species of Hemiptera-Heteroptera. 1911	$ .25
h, J. B. Contribution Toward a Monograph of the Noctuidae of Temperate North America.—Five parts, Mamestra, Xylophasia and Superina, Some Taeniocampid genera; Homohadena, Agrotes. (May be had separately) Set	$2.25

TABLE OF CONTENTS FOR THIS NUMBER

PROCEEDINGS

OF THE

NTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVII, No. 3

SEPTEMBER, 1915

PUBLISHED QUARTERLY BY THE SOCIETY

OFFICE OF PUBLICATION

2419-21 GREENMOUNT AVE.,

BALTIMORE, MD.

EDITORIAL OFFICE

WASHINGTON, D. C.

Entered as second-class matter at the postoffice at Baltimore, Md., February 28, 1913, under the Act of August 24, 1912

The regular meetings of the Society are held on the first Thurs[...]
each month, from October to June inclusive, at 8 P. M.

Annual dues of active members, $3.00; of corresponding members [...]
initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1915.

President...A. N. CAUD[...]
First Vice-President...C. H. [...]
Second Vice-President...E. R. SAS[...]
Recording Secretary...A. B. GA[...]
Corresponding Secretary-Treasurer...S. A. RO[...]
U. S. National Museum, Washington, D. C.
Editor...J. C. CRAWF[...]
Representing the Society as a Vice-President of the Washington Academy of Sciences...W. D. HUNT[...]

Executive Committee.

THE OFFICERS.

E. A. SCHWARZ. A. L. QUAINTANCE. C. L. MA[...]

PROCEEDINGS

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published quarterly by the Society at Baltimore, Md., and Wash-
ington, D. C. Terms of subscription: Domestic, $2.00 per annum;
foreign, $2.25 per annum; single numbers, 50 cents, foreign postage
extra. Remittances should be made payable to the Entomological
Society of Washington.

ANNOUNCEMENT

Separates of all the important papers published in the PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON and a number from other journals are for sale at approximately two cents per page (no article less than ten cents). They can be had by applying to the Corresponding Secretary of the Entomological Society, U. S. National Museum, Washington, D. C. No receipt will be mailed for the sale of printed matter unless especially requested.

OF SPECIAL INTEREST

SASSCER, E. R. Catalogue of recently described Coccidae. V.	$ .20
CUSHMAN, R. A. A Revision of the North American Species of the Braconid Genus Habrobracon	.20
DYAR, H. G. Synoptic Tables of the North American Species of Chionobas	.10
Synopsis of the North American Species of Erebia	.10
Synopsis of the North American Species of Brenthis	.10
A Generic Revision of the Hipocritidae (Arctidae) (Can. Ent.)	.10
A Generic Revision of the Lachneidae (Lasiocampidae) (Can. Ent. 1898)	.10
A Review of the Hesperidae of the United States	.20
BUSCK, AUGUST. A Revision of the American Moths of the Family Gelechiidae with Descriptions of New Species	1.00
A Review of the American Moths of the Genus Cosmopteryx Hubner	.15

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVII, No. 3

SEPTEMBER, 1915

PUBLISHED QUARTERLY BY THE SOCIETY
OFFICE OF PUBLICATION
2419-21 GREENMOUNT AVE.
BALTIMORE, MD.

EDITORIAL OFFICE
WASHINGTON, D. C.

Entered as second-class matter at the postoffice at Baltimore, Md., [illegible]
under the Act of August 24, 1912

The regular meetings of the Society are held on the first Thursd
each month, from October to June inclusive, at 8 P. M.

Annual dues of active members, $3.00; of corresponding membe
Initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1915.

President .... A. N. CAUD
First Vice-President .... C. H. T
Second Vice-President .... E. R. SASS
Recording Secretary .... A. B. GA
Corresponding Secretary-Treasurer .... S. A. ROHW
U. S. National Museum, Washington, D. C.
Editor .... J. C. CRAWF
Representing the Society as a Vice-President of the Washington Academy of Sciences .... W. D. HUN

Executive Committee.

THE OFFICERS.

E. A. SCHWARZ. A. L. QUAINTANCE. C. L. Ma

PROCEEDINGS

ENTOMOLOGICAL SOCIETY OF WASHINGTON

Published quarterly by the Society at Baltimore, Md., and Wa
ington, D. C. Terms of subscription: Domestic, $2.00 per annu
foreign, $2.25 per annum; single numbers, 50 cents, foreign pos
extra. Remittances should be made payable to the Entomolog
Society of Washington.

ANNOUNCEMENT

Separates of all the important papers published in the PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON and a number from other journals are for sale at approximately two cents per page (no article less than ten cents). They can be had by applying to the Corresponding Secretary of the Entomological Society, U. S. National Museum, Washington, D. C. No receipt will be mailed for the sale of printed matter unless especially requested.

OF SPECIAL INTEREST

LECONTE, J. L. Synopsis of the Species of Clivina and allied Genera inhabiting the United States .... .20

CROTCH, S. R. A check list of Coleoptera of America north of Mexico with Supplement (in bound covers and annotated) 1.00

LISELL, M. L. Descriptions of New Species of North American Coleoptera of the Families Cerambycidae and Scarabaeidae .... .15

On the Coleopterous Insects of the Galapagos Islands .... .25

Description of Some New Species of North American Heteromerous Coleoptera .... .10

New Genera and Species of North American Curculionidae .... .20

PRELL, HEINRICH. Revision of the Dynastinen-Genus Heterogomphus .... .25

SCHAEFFER, CHAS. A Few New Coleoptera of the Genus Ditoma with notes on Other Colydiidae .... .10

Additions to the Carabidae of North America with Notes on Species Already Described .... .10

each month, from October to June inclusive, at 8 P. M.

Annual dues of active members, $3.00; of corresponding members ...
initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1916.

President .... A. N. CAUDEL...
First Vice-President .... C. ...
Second Vice-President .... E. R. SAS...
Recording Secretary .... A. B. GA...
Corresponding Secretary-Treasurer .... S. A. ROHWE...
U. S. National Museum, Washington, D. C.
Editor .... J. C. CRAWF...
Representing the Society as a Vice-President of the
Washington Academy of Sciences .... W. D. HUNTE...

Executive Committee.

THE OFFICERS.

E. A. SCHWARZ. A. L. QUAINTANCE. C. L. M...

PROCEEDINGS

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published quarterly by the Society at Baltimore, Md., and Wash-
ington, D. C. Terms of subscription: Domestic, $2.00 per an...
foreign, $2.25 per annum; single numbers, 50 cents, foreign post...
extra. Remittances should be made payable to the Entomol...
Society of Washington.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVII, No. 4

DECEMBER, 1915

PUBLISHED QUARTERLY BY THE SOCIETY

OFFICE OF PUBLICATION

2419-21 GREENMOUNT AVE.

BALTIMORE, MD.

EDITORIAL OFFICE

WASHINGTON, D. C.

[illegible]

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME XVII, No. 4

DECEMBER, 1915

PUBLISHED QUARTERLY BY THE SOCIETY

OFFICE OF PUBLICATION

2419-21 GREENMOUNT AVE.

BALTIMORE, MD.

EDITORIAL OFFICE

WASHINGTON, D. C.

Entered as second-class matter at the postoffice at Baltimore, Md., February 28, 1913, under the Act of August 24, 1912.

The regular meetings of the Society are held on the first Thursday of each month, from October to June inclusive, at 8 P. M.

Annual dues of active members, $3.00; of corresponding members ... Initiation fee (for active members only), $1.00.

OFFICERS FOR THE YEAR 1915.

President..A. N. CAUD...
First Vice-President..C. H. EL...
Second Vice-President..E. R. SAS...
Recording Secretary..A. B. GAHA...
Corresponding Secretary-Treasurer..S. A. ROHWE...
U. S. National Museum, Washington, D. C.
Editor..J. C. CRAWF...
Representing the Society as a Vice-President of the Washington Academy of Sciences..W. D. HUNT...

Executive Committee.

THE OFFICERS.

E. A. SCHWARZ. A. L. QUAINTANCE. C. L. MARL...

PROCEEDINGS
ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published quarterly by the Society at Baltimore, Md., and Washington, D. C. Terms of subscription: Domestic, $2.00 per annum; foreign, $2.25 per annum; single numbers, 50 cents, foreign postage extra. Remittances should be made payable to the Entomological...

TABLE OF CONTENTS FOR THIS NUMBER